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Philadelphia is continuing the work of selecting competent engineers for the heads of her municipal departments. An examination for the position of Chief of the Bureau of Highways, an office paying, we understand, a salary of some $6,000 a year, and involving the control of expenditures for the city's streets, is to be held on July 1. The Board of Examiners is to consist of Mr. Justus C. Strawridge, a prominent business man of Philadelphia; Mr. John H. Converse, of the Baldwin Locomotive Works, and Prof. Edgar Marburg, the head of the Civil Engineering Department of the University of Pennsylvania. Application blanks will be furnished by addressing The Director of Public Works, Philadelphia.

A civil service examination for a civil-service examiner on the State Commission of New York is to be held at Albany on or about Sept. 1. The Secretary of the commission at Albany will furnish blank applications showing the character and scope of the examination.

A new bridge over the Mississippi River at Rock Island is to replace the bridge designed by Mr. C. Shaler Smith 25 years ago for the Chicago, Rock Island & Pacific Ry. The new structure is called for by the increased weight of the traffic imposed upon it. It will be 30 ft. wide, instead of 19½ ft., between trusses; will be designed to carry 8,000 lbs. per lineal foot of its two tracks, instead of 5,000 lbs., which was the load for which the old bridge was calculated, and will consume about 50% more material in its construction. The present structure is about 2,500 ft. long.

The competition for the Montreal Bridge, which closed May 15, has not yet been decided. A large number of plans have been received, and we learn that their examination, and the award of the prizes, which have been delayed on account of the absence of the chief promoter of the enterprise in London, is to be begun at once.

The question of fixed or swinging bridges across the Chicago Drainage Canal has been made the subject of a committe report to the board. It is pointed out that to erect swing bridges at this time would cost about $1,500,000, and this expenditure would not be judicious at this time, owing to the narrow margin between resources and the probable cost of the canal. Though fixed bridges are to be used at first, the board has the right at any time to compel the construction of swing bridges where they are deemed necessary. They would not be needed, in any event, until the general government makes the canal navigable as far as Lockport or Joliet, by improving the Desplaines and Illinois rivers.

A record of 80 miles per hour is claimed to have been made by an electric motor on the Nantasket Beach branch of the New York, New Haven & Hartford Ry. this week. A hot-box shortened the trial run at this speed to three miles, but the officials of the road declare that that rate was reached. The roadbed was the old one, laid with the 70-lb. "Old Colony" rail, united at the joints by two 7-in. copper bonds under the base of the rail. The two tracks are 15 ft. apart between centers, and between them is a single line of poles carrying the trolley wires. The power house is situated midway between the termini, and in it are two tandem compound engines and two direct-coupled generators, arranged to run from no load up to 1,420 HP. The two generators were especially designed for this line; they have a speed of 110 revolutions per minute, and are guaranteed to develop 1,500 HP. each. The armatures are made of copper disks, each insulated from the other, instead of being wound as usual, and it is claimed that by this arrangement is is impossible for them to get out of repair. There are four motor cars, built after the style of baggage cars, and each weighs 60,000 lbs. fully equipped. Two of these will have four motors each, and the other two, two motors each. The cars are equipped with Westinghouse air-brakes, and will be run in trains of from four to nine cars. The curves on this road are many and sharp, and the grades are steep.

A freight-hauling test by electric motors was held on June 25 on the Nantasket Beach railway. According to the report issued by the officers of the road, the motor car, equipped with four motors, hauled 16 heavily-loaded freight cars at a speed of about 25 miles per hour, with abundant power to spare. The load was about 450 tons. Other tests of the same nature are to follow.

The most serious railway accident of the week was the derailment of a northbound express train on the Missouri, Kansas & Texas Ry., near Houston, Tex., on June 19. A trestle over a branch of White Oak bayou had been thrown out of line by the floods, and though the engine kept the track, the tender and three cars were derailed and upset. Six persons were injured, one fatally.——A collision between a westbound passenger train and an eastbound freight train occurred June 21 at Copake, N. Y., on the Philadelphia, Reading & New England R. R. There were six persons injured, and both engines and several cars were wrecked.

A cable car descending the Lookout Mountain Incline R. R., at Chattanooga, Tenn., on June 19, jumped the track a little distance from the top of the steep grade, but was stopped by the automatic brakes. Two persons were seriously injured by jumping from the car.

A grade-crossing collision of steam and electric cars occurred at Sharpsburg, Pa., June 25. While an electric car of the Citizens' Ry. was crossing the West Pennsylvania R. R., the trolley got off the wire, and before the conductor could replace it, a freight train struck and wrecked the car. Of about 30 persons on the car, five were injured, one probably fatally.

The boilers of the water-works pumping station at Union City, Tenn., exploded June 17, killing the engineman and wrecking the building, and the city was left without water supply or electric light for some time.

The sheds at the car yard of the Southern Pacific Ry., at Portland, Ore., were destroyed by fire recently, and about 16 freight cars were burned.

A burst steam pipe on the whaleback passenger steamer "Christopher Columbus" caused the death of two men and the injury of 13 others on June 22. The steamer was returning from her first summer excursion to Milwaukee, and was racing with the rival steamer "Virginia," which had beaten the other steamer on the run to Milwaukee. According to press accounts, the boiler pressure had reached about 180 lbs., when the valve in a 6-in. connecting pipe over the starboard battery of three boilers blew out. It is said that the boilers were strained by a recent test at which the pressure was carried up to 250 lbs.

An addition to the embankments of the Queen Lane reservoir at Philadelphia has been recommended by Mr. John C. Trautwine, Chief of the Bureau of Water, and Mr. Rudolph Hering and Maj. C. W. Raymond, U. S. A., Consulting Engineers. The reservoir was recently completed, and on receiving water showed serious leaks. The above-named engineers find that the outer slopes range from 1.3 to 1 to 1.8 to 1. This, they state, is too steep for the material employed, as is shown by the slides or washes which have already occurred. It is therefore recommended that all the outer slopes, except where the embankment is less than 10 ft. high, be increased to 2 to 1. To accomplish this, the base can be extended in some parts, while in others a retaining wall will be necessary. This work will be entirely independent of the stopping of present leaks, but by increasing the stability of the structure may prevent new ones. More study, the experts state, will be required before recommendations can be made for rendering the reservoir embankments impervious.

The bullet-resisting shield invented by Mr. W. F. Lennard was unofficially tested before army officers at Governor's Island on June 25. Two shields were tested, each about 10 × 12 ins. and 2 ins. thick; one intended to resist lead bullets at 45 to 50 caliber at short range, and the other to resist steel-jacketed projectiles from the Krag-Jorgensen rifle. No. 1 shield weighed 16 lbs., and at 100 yards range stopped six ordinary bullets with a penetration of 1¾ ins. No. 2 shield, weighing 22 lbs., stopped five shots in a 3-in. circle from the Krag-Jorgensen rifle, with a penetration of ¾ in. Mr. Lennard claimed that his principle, which he keeps a secret, would apply as protection to military tops on ships, as shields for rapid-fire and machine guns on torpedo boats, turrets, etc. He stated that it could be made to resist shots from a 13-in. gun at about the same cost as Harveyized armor, with the advantage that it was 40% lighter and more easily fitted. The army officers present would not commit themselves as to the merits of the new armor.

A contract was made with the Bethlehem Iron Co. in 1891 for 100 army rifled guns, divided as follows: 25 8-in., 50 10-in., and 25 12-in. high power modern sea-coast rifles, costing about $3,500,000. The first, or type 8-in. rifle on this contract will be completed this month, and the type rifles of the other calibers are nearly finished. The government awarded this contract with the purpose of creating a private plant for the manufacture of heavy sea-coast rifles as an addition to the army gun plant at Watervliet, and the Bethlehem Co. is said to have expended nearly $1,000,000 in enlarging its plant for this purpose. The guns are all made on the Ordnance Department model.

The naval display at the opening of the Baltic ship-canal included 51 war-ships of all types, but generally modern in design. Italy sent the heaviest ship, in the "Sardegna," of 13,860 tons; and the United States sent the largest and fastest cruiser in the "Columbia," of 7,500 tons and 22.8 knots speed, and one of the two fastest armored cruisers afloat, in the "New York." The Spanish "Maria Teresa" ranks with the "New York," with 20 knots speed. The Russian "Rurik" is claimed to be at present the largest armored cruiser afloat, having a displacement of 10,923 tons, with 13,558 I. HP., and a speed of 19 knots. The "New York," "Columbia" and "Rurik" all have great coal capacity, and the "Columbia" has made a shorter voyage across the Atlantic than any war vessel afloat.

The Port Royal, S. C., dry-dock, completed last year by the general government, is not yet available for docking warships of 26 ft. draft. Much dredging will have to be first done in the entrance channel and anchorage in front of the dock, and a new survey is being made of the bar at the entrance to the river. The last chart is said to show 26 to 27 ft. on this bar at high tide, with shallow spots.

The Canadian Canal contracts at Sault Ste. Marie are being investigated by the Public Accounts Committee at Ottawa, says the Montreal "Witness." In 1889 the following bids were made for the canal, locks, etc.:

Lower entrance,		Ryan & Harvey	$299,313
"	"	Murphy & McGreevy	322,000
Upper	"	John Nicholson	231,000
"	"	Allan & Fleming	325,000
"	"	Hugh Ryan	348,000
Lock contract,		" "	1,282,597
"	"	Goodwin & Co.	1,163,692
"	"	Conmee & Co.	1,225,580

Ryan & Harvey received the contract for the lower entrance; Allan & Fleming that for the upper entrance, and Hugh Ryan the contract for the lock; the department decided that the other two lock bids were too cheap. Mr. Nicholson bid $608,000 for both the upper and lower entrances, and claimed that his was the lowest tender for the two; but he received no satisfaction. After the contract was let, the lock was enlarged to 100 ft. wide, 650 ft. long and 19 ft. deep, instead of 600 × 85 × 16 ft., as bid for. A second change was made to 900 × 60 × 20 ft., in April, 1892, adding $190,000 to the contract. Other additions were: Changes in culverts, $121,000; deepening channel, etc., $107,000. The total cost completed was $3,520,000, including a residence for the superintendent. The inquiry is still in progress.

Another trial of road-motors was made recently in France in a race between Paris and Bordeaux. The first to arrive at Bordeaux was the Panhard & Lavassor petroleum motor, which made the distance of 362.7 miles in 22 h. 28 m., or an average speed of 15.13 miles per hour.

The Columbia & Maryland Electric Railway Co. is being formed in Baltimore by the consolidation of the following companies: The Belt and the Eckington and Soldiers' Home companies, of Washington, D. C., with 80 cars and 28 miles of track; the Baltimore and Washington Turnpike Co., with 30 miles of route; the Maryland and Washington Ry. Co., in the District of Columbia, 50 miles, and the company of the same name in Maryland, 30 miles; and the Edmondson Ave., Catonsville & Ellicott City Electric Co., now building 10 miles of track in Baltimore and vicinity. The new company will be limited to $6,000,000 in bonds and $4,000,000 in stock. The new officers are: Thomas M. Lanahan, President; B. N. Baker, Vice-President; Ernest McElroy, Treasurer; R. S. Carswell, Secretary, and W. K. Schoepf, General Manager. The line between Washington and Baltimore is to be completed at once.

THE CIVIL ENGINEER AND THE AMERICAN SOCIETY OF CIVIL ENGINEERS.*

The constitution provides that the President shall deliver an address at the annual convention, and it has been the custom to make this address a review of engineering works. I have thought right to depart from this custom, as the year has been one of unusual dearth in engineering construction, and I feel that it is the time to call attention to the true meaning and position of the profession and the society to which we belong.

Students of primitive society have divided the early development of the human race into ethnical epochs, representing various conditions of savagery and barbarism, and finally culminating in civilization. There is no reason why the epoch which culminated in civilization should be the last. It only needs a new capacity, radically unlike those which have gone before, to make an epoch in civilization as distinct as those in primitive society. Such new capacity has now been found; and another epoch has begun, for man has now learned to manufacture power or to change inert matter from one form to another in such a way as to generate power. Not only does the manufacture of power mark a new epoch in development, but the change is greater than any which preceded it, both in its influence on the world and in the results which are to come.

The manufacture of power means that wherever needed we can now practically produce unlimited power; whatever the measure of a single machine, that machine can be used to make a greater one; we are no longer limited by animal units, confined by locations of waterfalls, nor angered by the uncertain power of wind; power can be had where it is needed and when it is needed; the manufacture of power has enabled us to concentrate in the hull of a single ship twice as much force as is developed by the whole water-power of the Merrimac at Lowell, and this is but a trifle of what may be done. The epoch is a great one, and means more to our own profession than to any other. The manufacture of power is the work of the engineer, the inventions which have led to it were made by engineers; in fact, it has made possible the profession of the civil engineer. The new epoch has barely begun. No exact dates can be fixed, for epoch-making is not a matter of a single invention. James Watt developed his first steam engine in 1769. The steam engine began to come into general use about the beginning of this century. The nineteenth century has seen the development of the manufacture of power by steam, and the steam engine is still almost the sole representative of manufactured power, but there is no reason why this should continue. Electricity as a conveyer of power has been developed to an extent which may almost be classed with manufactured power. New forms of manufactured power may come at any time; but the introduction of new forms is a comparatively unimportant thing. The great advance came with the ability to manufacture power at all; the method is a secondary thing.

Let us consider what civil engineering is. Telford's definition, incorporated in the charter of the Institution of Civil Engineers, is familiar to all: "The art of directing the great sources of power in nature for the use and convenience of man." The constitution of the American Society of Civil Engineers fixes as a requirement for full membership "the ability to design as well as direct engineering works." The English definition and the American requirement taken together explain what constitutes a civil engineer. His business is to design the works by which the great sources of power in nature are directed. His works are not built for themselves nor as commemorative monuments; they are made to direct the powers of nature for the use of man; every engineering work is built for a special ulterior end; it is a tool to accomplish some specific purpose. Engine is but another name for tool; the business of an engineer relates to tools; a civil engineer must be capable of designing as well as handling tools. The highest development of a tool is an engine which manufactures power. All the great possibilities of our profession come from the existence of such tools.

It is a common error to think of civil engineering as a co-ordinate branch of a general profession with many other branches. The name of every special branch of engineering has a distinctive meaning; the mechanical engineer deals with machines, the hydraulic engineer with water, the mining engineer with mines, the sanitary engineer with drainage and the railway engineer with railways. The word "civil" has no such distinctive meaning; it only shows that civil engineering is the work of the citizen and not the work of the soldier. Civil engineering in its true meaning embraces every special branch of engineering. The professional limitation which should be applied to the civil engineer is that he must be a man who, in his own department, can design as well as direct; he must have that control over his work which nothing but intelligent knowledge of the subject gives; he may be a railway builder, a skillful surveyor, a mechanical engineer, or he may follow any other specialty; but whatever he does he must do it, not as a skillful workman, but as one qualified to design. Any man who is thoroughly capable of understanding and handling a machine may be called a mechanical engineer, but only he who knows the principles behind that machine so thoroughly that he would be able to design it or to adapt it to a new purpose, whatever that purpose may be, can be classed as a civil engineer. The business of every engineer is to handle tools; the business of the civil engineer, whatever department or specialty he may follow, is to design and build those tools rather than to use them. I use the word tool in its largest sense; you may call it engine if you prefer. Any constructed thing whose principal object is to produce something outside of itself is a tool, whether that tool be a bradawl, a steamship or a railway. Civil engineering embraces all branches of engineering, but the civil engineer differs from other engineers in that he makes tools rather than uses them. The relation of civil engineering to all other branches is of the broadest kind; no branch of engineering is excluded; the only exclusion is based on the individual qualifications of the men.

The civil engineer is briefly a man who, with knowledge of the forces and materials around him, uses that knowledge in the design and construction of engineering works. His business is to design the tools by which the sources of power in nature are directed for the use of man. A body of civil engineers should include the choicest minds in every branch of the engineering profession.

Our constitution provides that a member shall be a civil, military, naval, mining, mechanical, electrical or other professional engineer, an architect or a marine architect, qualified to design as well as to direct engineering works It would, perhaps, have been better expressed if it had said that any such man who, with knowledge of the great sources of power in nature, uses that knowledge in the design and direction of engineering works is qualified to be a member. We welcome into our society all branches of engineering, but not all engineers. We welcome every engineer who applies a knowledge of the powers of nature to the design and construction of engineering works; we welcome the architect who uses this knowledge in his designs and constructions, but the architect, who treats his profession as a fine art to decorate a construction which he cannot design, belongs elsewhere. Intelligent knowledge of the great powers in nature is the fundamental requirement for a civil engineer. On this substructure a superstructure of actual design and construction must be built to make the complete professional man.

The civil engineer of the new epoch, the epoch which he is bringing into existence by the manufacture of power, must be an educated man; in no profession will this be more necessary. The physical laws of power and strength are mathematically exact and admit of no trifling. As the epoch progresses the requirements for each individual will become more complicated. The engineer cannot shield himself under doctrines of theories which he accepts but cannot understand. Dealing ing with accurate definite laws, and guided by the corrective touch of physical nature, the education of the engineer will become more necessary, more thorough and more exact than that of any other professional man. This is the training which the civil engineer of the new epoch must have, or he must be classed as a workman rather than a professional man.

The civil engineer of the new epoch must sink the individual in the profession. The best work is never done by separate men; it is only accomplished when professional knowledge so permeates all members of a profession that the work of one is virtually the work of all. The first steps are made by individuals, but the best results come later. The name of Watt will ever be identified with the successful introduction of the steam engine, and nothing should be allowed to belittle his reputation, but there are ten thousand men to-day any one of whom can build a far better engine than James Watt ever could; they can do it because they are imbued with all the work the engine builder has done for more than a century; they do it as members of a profession who are all working together. In no period of the world's history has marine construction had any significance compared with what it has to-day, and it is because the great ship builders are working together, each having the practical benefit of what they all are doing; they are working together as members of a profession rather than as individuals, and their work is becoming more uniform and more perfect.

The civil engineer must be a specialist. No man can learn to design all the tools by which the powers in nature art to be directed. The work is too great for one man to master. But though the civil engineer must be a specialist, his specialty must not be of a narrow kind; he must have that general knowledge and training which make the liberally-educated man. The real difference between a liberal education and a special education is that one teaches the student to use his mind and the other gives him information.

Having now considered what should characterize the civil engineers of the new epoch, let us pass from civil engineers to the society which they have organized. The American Society of Civil Engineers is a national society, and its objects are defined in the constitution to be "the advancement of engineering knowledge and practice, and the maintenance of a high professional standard among its members," while the means to accomplish this purpose are broadly stated to be intercourse between members, professional papers and a library for professional use. Intercourse between members is perhaps the most important of all. In no other way can the standard of a profession be raised so well. The man who works alone without measuring himself by others never does his best. The engineer must both measure himself by what others do and let others measure him.

The preparation and publication of professional papers are another duty of the society. There is an important difference between the papers which must come before a society and those which are published elsewhere. Other professional publications are generally, like architectural monuments, records of what has been done, published for the preservation of those records, and not for much more. The fundamental feature of the papers of a professional society, on the other hand, is that, like every engineering work, they are tools; their work begins when they are read; they are intended to bring out discussions, to compare different views, and in this way to give the knowledge of the profession to all; it is in this line that most development is needed. The papers which are now published in our Transactions are many of them very good, but the discussions are not what they should be. An author may be best satisfied by the paper which is most perfect in itself, but the paper which brings out the fullest discussion is the most useful to the society. We have an endowed prize for a paper worthy of special commendation as a contribution to engineering science; and another endowed prize for a paper describing in detail accomplished works of construction. There should be a third endowment for a prize for the paper which calls out the best discussion of the year, and this prize should be given without reference to the awards of the other two, so that if the paper which receives the Norman medal also brings out the best discussion it will receive two prizes instead of one.

Our society has a professional library, but the facilities for using it are far from what they should be, and are a poor fulfillment of the constitutional requirement for the establishment of facilities for its use. Every book on an engineering subject ought to be found on the shelves soon after it is published, and engineers should find this library as convenient a workshop as the library of the Bar Association is to members of the bar. It should be open not only during the daylight hours, but late into the evening, so that the older engineers, who have no time in the day, and the younger men, who have nowhere else to go in the evening, can realize the full benefit of its worth. In a new society house separate and safe provision for the library must be given special attention.

The society must work for the profession rather than for the individual; its duties are the advancement of engineering knowledge and practice and the maintenance of a high professional standard. It must not mix itself up with the affairs of individuals; it has no secret rites nor arbitrary rules; with scales of charges it has nothing to do; it will not demean its members by putting itself on the basis of a labor organization. High professional standards can never be maintained by agreements which restrict the free right of the individual to receive such compensation, large or small, as his own ability has shown he is worth; it can only be maintained by that true professional spirit which sinks the individual in the whole.

The relations which our society should bear to the other national engineering societies is established by the definition of civil engineering. Our society should include the choicest minds in every branch of engineering; it must have among its members the leading members of every society which represents an engineering specialty. No other society can have our general range; on the other hand, no other national society can make the same restrictions as to individual requirements. Each of the other societies is devoted to some specific branch of engineering, but the individual qualifications should be comparatively light; it receives into its ranks every engineer working in its specialty; as we receive engineers of every specialty but not every engineer.

* Abstract of the address of Mr. Geo. S. Morison, President of the American Society of Civil Engineers; delivered June 19 at the annual convention of the Society at Nantasket.

The relation which our society is to bear to the various local societies is of a different character. These societies are intended to bring together the engineers of the immediate neighborhood in which they are established. Their opportunities for social intercourse and for frequent discussions are necessarily greater than those of a national society. Their requirements for membership should be more liberal than those of any national society. Like our society, they should receive members from every branch of engineering; like the mechanical and other special societies, they should admit every one who is qualified to take responsible charge of work in his department. The qualification for a member of the Western Society of Engineers, the Chicago local society, are simply that he must have been engaged for five years in some branch of engineering. It would be an appropriate thing for those local societies who now have it in their title to drop the "Civil" and let them all become "Societies of Engineers," restricted only by convenience of location.

As the national societies all have their headquarters in the same city, any engineer residing in or near New York may find all that he needs in one or more of the national societies, but it is hoped that in time every non-resident member will also be a member of one of the local societies.

The differences between our society and the several other classes of engineering societies are of so radical a nature that it would be a dangerous thing to try in any way to consolidate or unite them. We cannot unite without entirely changing the qualifications for membership. No idea of uniting with the other national societies has ever been suggested. We cannot unite with the various local societies without either so widening the qualifications of our membership that we shall cease to be a society of civil engineers, or so restricting the qualifications of their membership that the ranks of many of them would be destroyed. But though we cannot unite with any of the other societies, it is our duty, as the leading engineering society of America, and one of the leading societies of the world, to treat all other technical organizations with the same generous kindness and courtesy which should characterize the treatment of gentlemen by gentlemen, of professional men by each other. The members of the different local organizations should be welcomed to our headquarters, and we should freely exchange our publications with other societies, esteeming it a privilege, if we are able to give them more than they give us.

THE CHICAGO MAIN DRAINAGE CHANNEL.

VI.

Willow Springs Division, Sections F and E.

The Willow Springs Division of the Drainage Channel begins at the east end of Section F and extends to the west end of Section 1, a distance of about 7½ miles. Beginning at the east end of Section F the channel is 110 ft. wide at the bottom to a point within 500 ft. of the west end of the same section, where it widens out to the normal section 202 ft. wide on the bottom, and continues this width to the east end of Section 1, where the rock channel, 160 ft. wide at the bottom, begins. The side slopes are 2 ft. horizontal to 1 ft. vertical. The first of the river diversion channel work occurs on this division. The engineer of the division is Mr. H. B. Alexander, whose offices are located at Willow Springs, Ill. We are indebted to Mr. Alexander for much aid in securing the matter for the articles on Sections F to 1, inclusive.

Section F.—This section is notable as involving the first work of river diversion, and also as being the first section yet described which has been taken from the original contractors and relet. The original contract for the section was signed by Ricker, Lee & Co., of Galveston, Tex., Nov. 23, 1892, and called for the removal of 1,399,495 cu. yds. of glacial drift, and 45,900 cu. yds. of solid rock at 23¾ cts. and 80 cts. pr cu. yd., respectively. Later estimates (Jan. 1, 1895), based on more accurate data, reduced the quantities on the section to 1,251,887 cu. yds. of glacial drift and 16,724 cu. yds. of solid rock. About 70,000 cu. yds. of the glacial drift excavation was on the river diversion channel.

The contractors began work promptly after signing the contract, and on Jan. 1, 1894, were considerably ahead of the contract requirements in the amount of excavation completed. On April 3, 1894, however, they notified the Board of Trustees that a very hard material had been encountered in the glacial drift work, which could not be excavated at the price they were receiving—viz., 23¾ cts. per cu. yd.—and asked that a readjustment of the price be made for this hard material. The argument made by the contractors in support of their request was that the borings made by the engineers to determine the character of the material failed to indicate in any way the presence of this hard material, and were thus misleading.

Similar complaints having been made by the contractors working the succeeding Sections E, D and C, the Board of Trustees appointed a special committee of adjustment to consider the question of the claim for hard material on the four sections named. As the investigations and decisions of this committee apply to Sections E, D and C, which will be described in future articles, as well as to Section F, now under consideration, and because they established the policy of the Board of Trustees in future disputes of similar nature, they are given here in some detail. It should be stated that in the very beginning the claims of the contractors for Sections D and C were set aside, so that in reality the following discussion refers only to Sections F and E.

The investigations of the committee consisted in sinking a series of 6 × 6-ft. test pits at intervals along the sections in dispute, the investigation and report of a commission of seven engineers from the engineer corps of the Drainage District, and the testimony of a number of well-known contractors. The test pits which were sunk, in the words of the Chief Engineer's report, "disclosed the fact that the material to be excavated was of a more difficult character than was indicated by the simple borings." They also disclosed the existence of a large amount of a peculiar quicksand underlying the hard material. The commission of engineers was divided in its opinion. Four members, including the Chief Engineer, agreed that an increase in price to 41 cts. per cu. yd. for the material remaining on both sections would be a just valuation of the work, and two members, including the Assistant Chief Engineer held that there should be no increase in price for Section E, but considered that an increase of 6¼ cts. per cu. yd. might be justly allowed on Section F. Some of the engineers also suggested that the quicksand which had been shown by the test pits could perhaps be handled by hydraulic dredges. The advice of a committee of contractors was secured to consider this question of dredging, and its opinion was in substance that dredging would not work satisfactorily, and perhaps not at all. The question of handling this quicksand, however, assumed no importance, as the contractors on both Section F and Section E agreed to take their chances with it, providing the prices for hard material be raised to 50 cts. and 53 cts. per cu. yd., respectively, on these sections.

The committee of adjustment was divided in its opinion as to what action to pursue in the face of the testimony, but finally presented a majority and a minority report. The majority report recommended that no increase in price for hard material be allowed, and this report was adopted and acted upon by the Board of Trustees. The argument of the majority report seems to have been that any action granting relief would be a precedent which would involve serious annoyance from other contractors who might encounter material a little harder than they had anticipated, and claim an adjustment of prices. It was also considered reasonable to suppose that the contractors should have allowed for contingencies of this character in making their bids, and if by a mistake in judgment they had not made sufficient allowance, the Drainage District should not be expected to stand the loss.

The minority report, on the other hand, held that the early completion of the canal was paramount to questions of precedent, and that where grievous hardship devolved on the contractor on account of errors to which the Board of Trustees was a party, they were bound to do what equity might require. The test pits proved that the small borings had not indicated the true character of the material, and to declare the contract forfeited and relet the section to new contractors would take at least six months. For these reasons the minority report recommended that relief be afforded to the contractors by placing the price of the hard material at 50 cts. per cu. yd., so that work might be continued without interruption.

FIG. 22. VIEW OF BRIDGE CONVEYORS ON SECTION F; Weir & McKechney, Contractors.

Although failing to receive the relief they had expected, the contractors for Section F prosecuted work until the early part of the month of November, 1894. During that month the Chief Engineer reported the work delinquent, and later the section was ordered relet to new contractors. In January, 1895, the new contract was let to Wier & McKechney, of Cincinnati, O., at 29½ cts. per cu. yd. for glacial drift and 90 cts. per cu. yd. for solid rock.

As the first contractors had excavated 662,527 cu. yds. of glacial drift, there remained 589,360 cu. yds. of glacial drift and 16,724 cu. yds. of solid rock for the new contractors to take out. The work of the two firms of contractors is taken up in the order of their contracts in the following paragraphs.

Before describing the methods of excavation adopted, it is important to get a clear understanding of the character of the material. The top soil is the usual soft prairie loam, which becomes more and

FIG. 23 VIEW OF SPILLWAY NEAR HEAD OF RIVER DIVERSION CHANNEL.

more clayey in character as the depth below the surface increases. Underlying this is a stratum of very hard "indurated clay." This layer of clay constitutes the bulk of the intractable material about which the difficulty just described arose. In order to dig it with any degree of success, blasting is necessary, and owing to the toughness as well as the hardness of the clay, the explosive, instead of shattering it, tears it out in large blocks, which often have to be broken with small blasts before they can be handled. Coupled with the hardness of the material is the annoyance of frequent boulders, which are scattered through and firmly imbedded in the clay. Below the clay are beds of the peculiar quick-acting sand previously noted. This sand is so soft that a person quickly sinks into it, and is also somewhat viscid; thrusting against it with the foot causes it to shake, jelly-like, for a considerable distance around the point of pressure. Owing to this peculiar action, the sand has been given the name of "bull liver." If the hand is thrust into this "bull liver" and withdrawn the material clings to the fingers in long, stringy masses. No experience has yet been had in handling this material, and it is not known how difficult it may prove to excavate.

The first contractors, Ricker, Lee & Co., began work by excavating the first 5 or 6 ft. in depth over the whole section with wheel scrapers. Steam shovels were then put at work in a cut about 12 ft. to 14 ft. deep, running lengthwise of the section. Four trains of Thacher dump cars were used to convey the excavated material to the spoil bank, two trains for each shovel. One locomotive for each shovel was used to place the cars, and the other to haul the trains to and from the spoil bank. The Thacher dump car used is deserving of mention in one or two particulars, principally on account of the dumping mechanism. Each car is provided with an air cylinder, the piston of which when forced out dumps the car. These cylinders are connected with the air pump on the engine in a manner somewhat similar to the well-known air-brake, and just as the enginesman can apply the air-brakes in ordinary train service, he can dump the Thacher cars from the engine.

Bucyrus steam shovels were used, and, as indicated above, when working in the indurated clay had to have the material blasted in front of them. Dynamite and black or Judson powder were used as explosives, and the holes drilled from 16 ft. to 18 ft. deep. On an average 14 men were employed in drilling and blasting, working Sundays and generally five nights in the week. With the material blasted, the shovels handled about 350 cu. yds. per 10-hour shift, when working.

The system of excavation adopted by the present contractors, Weir & McKechney, is practically identical to the one used on Sections K and I. A cut is made transversely across the channel by a steam shovel, which loads into dump cars. The cars are hauled across the bottom of the channel, up the slope, and onto a bridge which spans the spoil bank, and are then dumped through the open floor of the bridge. Instead, however, of a berm of 80 ft. between the channel and spoil bank, as is the case on Sections K and I, there is here a berm of several hundred feet, with a corresponding increased length of haul. Two bridges or conveyors are used, both starting near the middle of the section, and one working each way towards the ends. Fig. 22 is a view of the bridges taken before the falsework for erection had been removed from under one of them. Both spans are combination wood and iron, and are 210 ft. long. The cars are hauled by cable, the winding engines being placed in the houses shown near the foot of the trestle incline. The houses, inclines and trusses are mounted on trucks so that they can be moved along the track as the work proceeds.

Thus far sufficient excavation has not been done with these bridge conveyors to show their capacity. Barnhart's AA type of steam shovels, manufactured by the Marion Steam Shovel Co., of Marion, O., are used to load the cars.

River Diversion Channel and Spillway.

So far little mention has been made of the important work of river diversion and its auxiliary constructions. For long distances the route of the main channel occupied the bed of the Desplaines River, and almost its entire length was subject to inundation during flood seasons. It will be readily seen, therefore, that plans for diverting this stream had to be carried to completion before much work could be done on the main channel. These plans provided for the construction of a river diversion channel running almost parallel with the main channel and separated from it by a levee high and strong enough to hold back the most excessive floods. Since, however, only part of the flood waters had normally gone down the river through Lockport and Joliet, Ill., it was inadvisable to force the entire column of water through that channel until it had been enlarged to the proper size. The enlargement of the channel through Lockport and Joliet could not easily be made until a later date, and so some temporary expedient was necessary to dispose effectually of the surplus flood waters without either forcing them through Joliet or allowing them to inundate the main channel. A safety valve in the shape of a spillway was therefore constructed near the head of the river diversion channel, which allowed all the flood waters beyond a certain amount to flow into the Ogden Ditch and Chicago River.

The river diversion channel begins on Section F and continues to the end of the main channel, sometimes following the old bed of the Desplaines River and sometimes an artificially-excavated channel. The location of this channel is shown in the general map of the drainage channel work.* Altogether there are 13 miles of artificial channel, 200 ft. wide on the bottom and with side slopes of 2 to 1. The levee separating the river diversion from the main channel is 19 miles long. The work of constructing the river diversion channel calls for no especial mention. Generally the diversion channel on each section of the main channel was excavated by the contractor of that section, but in some instances the Sanitary District did portions of the work for the purpose of giving work to the unemployed poor of Chicago.

The spillway at the head of the river diversion channel is a concrete dam capped with cut stone, and is 397 ft. long. The crest of the spillway is 16¼ ft. above Chicago datum, which prevents any flow toward Chicago until the flow of the Desplaines River has reached 300,000 cu. ft. per minute, and furthermore limits the possible height of water in the river to an elevation between 3 and 4 ft. above the crest of the spillway, thus insuring against an overflow of the south lines of the river diversion. It also limits the maximum flow toward Joliet to about 400,000 cu. ft. per minute.

Originally the flow toward Chicago commenced when the flood passing this point of the river reached 50,000 cu. ft. per minute. When the channel through Joliet is enlarged so as to accommodate the entire flood waters, the crest of the spillway will be raised so as to prevent any flow toward Chicago.

Fig. 23 is a general view of the spillway, and Figs. 24 and 25 show a plan and several sections

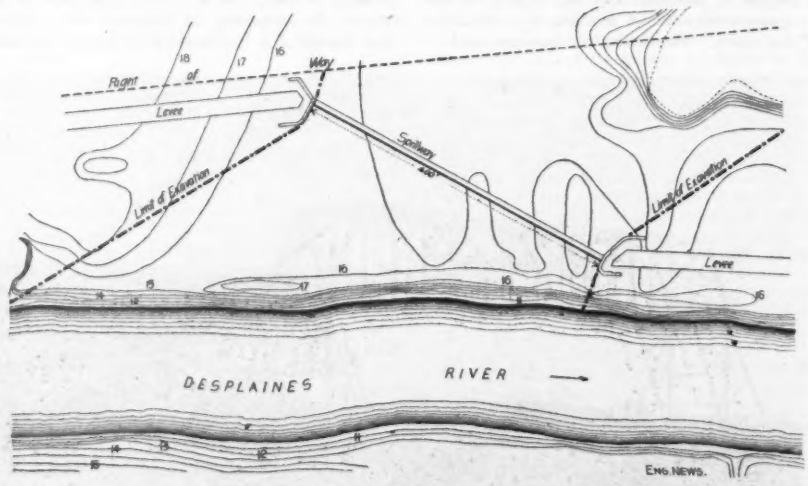


FIG. 24. PLAN OF SPILLWAY NEAR HEAD OF RIVER DIVERSION CHANNEL.

of the masonry. Stone masonry is used for capping the dam and facing a portion of the wing walls, but for all other parts of the structure concrete is used. The body of the concrete was composed of one part Louisville cement mortar and two parts broken stone. This mortar was made in the proportion of 300 lbs. of cement to 7 cu. ft. of sharp, clean sand, and the broken stone was required to be of such size that its greatest dimensions would pass a 2-in. ring. The cement and sand were first mixed dry, and then passed through a ¼-in. mesh sieve, and wetted as needed for use, the

* Eng. News, May 16, 1895.

broken stone being added to the wetted mortar. For plastering the exposed surfaces of the concrete work, German Portland cement mortar composed of 400 lbs. of cement to 3 cu. ft. of sand was used. This coating of plaster varied from ½ in. to 1 in. thick, and cost 75 cts. per sq. yd. The cost of the concrete was $6 per cu. yd. The figures of cost include everything—material, molds, etc.—including the hauling of all material about one mile from the railway by teams.

The method of doing the work was very simple. The Sanitary District entered into a contract with McArthur Brothers, of Chicago, whereby that firm was to furnish all labor, material and superintendence, and render bills for the labor and material to be paid by the Sanitary District, which was also to pay 10% on the cost of the work for superintendence. In shorter words, McArthur Bros. acted as agent of the Sanitary District for this particular work. The rock foundation was first cleaned, and then the concrete was placed in suitably-shaped molds and tamped in 6-in. layers. The capstones and other stone masonry were laid as the concrete work progressed to suitable points. It may be stated that the capstone masonry, which consisted of dimension stone laid in Portland cement mortar, cost $16.50 per cu. yd. The total cost of the spillway was $20,518.

The spillway has been called upon but once so far to act for the purpose for which it was constructed. In March, 1894, water flowed over the crest for a period of 61 hours. This flood, but for the intervention of the spillway, would have for the most part entered the Chicago River, and like its predecessors, swept pollution and disease out into the lake to be drawn into the water-works inlets. This may perhaps be said to be the first substantial benefit which the city of Chicago has reaped from her great sanitary work.

Section E.—Like Section F, this section has been taken from the original contractors and relet to others, as the result of the dispute already referred to as arising over the prices for hard material. The various phases of this dispute outlined in the description of Section F occurred in connection with Section E, and the final decision of the Board of Trustees was the same. The original contract for Section E was let to Streeter & Kenefick, Feb. 1, 1893, and called for the excavation of 1,840,773 cu. yds. of glacial drift, 67,465 cu. yds. of which were in the river diversion channel, and 5,000 cu. yds. of solid rock. The latest revised estimates give the amount of excavation on the section as 1,887,993 cu. yds. of glacial drift and 78,765 cu. yds. of solid rock. The prices for excavation were 27½ cts. per cu. yd. for glacial drift and $1 per cu. yd. for solid rock. The contract was taken from Streeter & Kenefick, Aug. 29, 1894, and relet to Angus & Grindele, Sept. 19, 1894, at 27 cts. per cu. yd. for glacial drift, and 80 cts. per cu. yd. for solid rock. This bid was the lowest of all received, and, it is to be noted, was ½ ct. per cu. yd. lower on glacial drift, and 20 cts. per cu. yd. lower on solid rock than the original price.

The first contractors, Streeter & Kenefick, began work soon after being awarded the contract, and on Jan. 1, 1894, were considerably ahead of the contract requirements for the amount of material excavated. Practically the same system of steam shovels and spoil trains was used to handle the hard material as has just been described for Section F, and the soft top soil was removed by wheel scrapers.

Angus & Gindele, the second contractors, also adopted the same system of steam shovels and spoil trains. Fig. 26 shows the arrangement of tracks adopted by them on the west half of the section. This plan was made from sketches made in April, 1895. As the steam shovel cut proceeds east, the track will be advanced, and ultimately there will be an incline connecting the tracks in the pit with those on the spoil bank at the east end of the section. Barnhart's AA type shovels are used to load the cars, the material being blasted ahead of the shovels. In addition to these shovels a large excavator, also built by the Marion Steam Shovel Co., Marion, O., has recently been completed. This excavator is a very large steam shovel built of wood and iron. An idea of its size may be gained from the following dimensions:

Weight	250,000 lbs.
Length of car	50 ft.
Width of car	23 "
Gage of car	25 "
Length of boom	55 "
Length of dipper handle	34 "
Size of engines	10×12 ins.
Size of boiler (locomotive type)	56 ins. × 20 ft.
Size of dipper	2 cu. yds.

Up to the present time sufficient excavation has not been done with this shovel to enable accurate figures of its capacity to be given. We shall give such figures, however, in a future article.

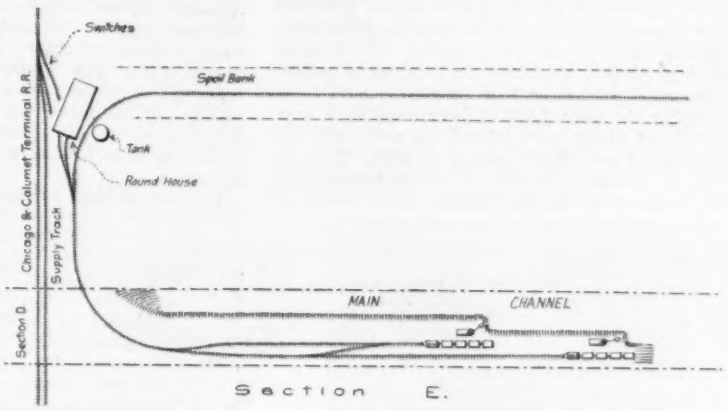


FIG 26. PLAN OF TRACKS SHOWING METHOD OF EXCAVATION ON SECTION E; Angus & Gindele, Summit, Ill., Contractors.

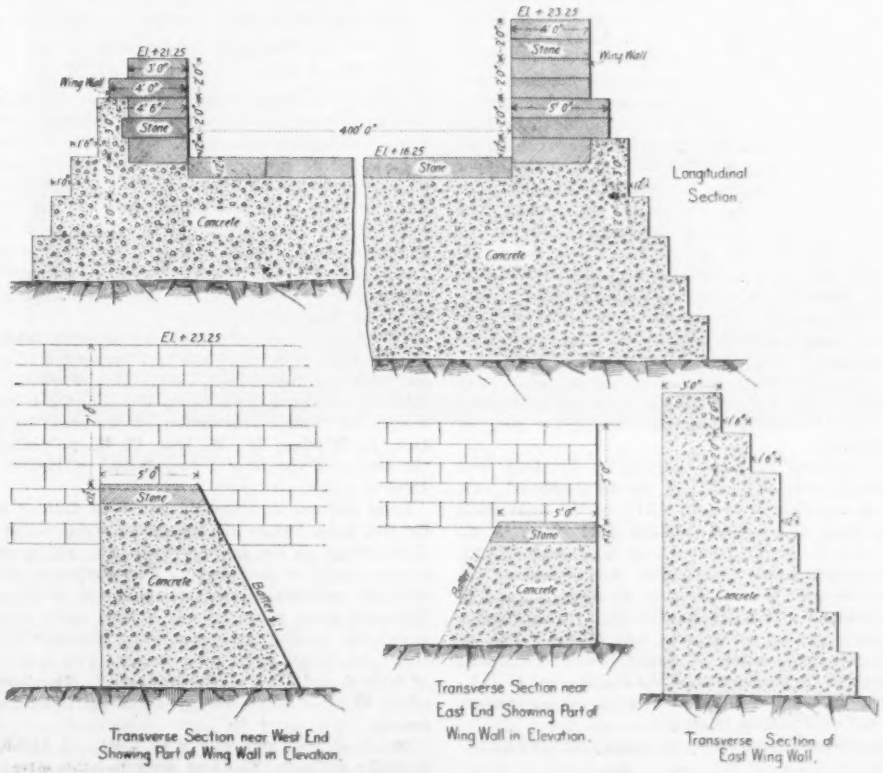


FIG. 25. SECTIONS OF SPILLWAY SHOWING CHARACTER OF MASONRY.

The New York & Brooklyn Tunnel Co.'s charter has been signed by Governor Morton. This company proposes to build a four-track tunnel under the East River.

STATISTICS OF RAILWAYS IN THE UNITED STATES IN 1894.

The report has just been issued of the Statistician to the Interstate Commerce Commission, covering the railways of the United States and their operation in the year ending June 30, 1894. This report covers a period of widespread and unprecedented railway depression, and on the date named 192 roads, operating 42,000 miles of line, and representing about one-fourth of the total railway capitalization, were in the hands of receivers.

On June 30, 1894, the total railway mileage in the United States was 178,708 miles, an increase of 2,248 miles over 1893. The total mileage of all tracks was 233,533, including 10,490 miles of second track, 953 miles of third track, 711 miles of fourth track and 42,662 miles of yard tracks and sidings.

The total number of railway corporations on June 30, 1894, was 1,924, an increase during the year of 22. Of this number 745 were independent operating companies, and 945 maintained separate operating accounts. The number of companies maintaining financial accounts only was 804, of which 334 were operated under lease for a fixed money rental, and 190 for a contingent money rental; 243 were controlled through the ownership of stock by the operating company; the remaining 37 returned no information as to the form of control. The number of roads not in operation was 77, of which 60 were independent roads; 10 were subsidiary roads, parts of systems, and 7 were private roads. In addition to the roads already referred to there were 98 private roads operated in connection with logging, milling and mining industries. The movement of consolidation during the year on the basis of mileage involved has been greater than for the year previous; 15 roads, representing 1,734.64 miles, have been merged; 22 roads, representing 2,351.99 miles, have been reorganized, and 14 roads, representing 1,590.34 miles, have been consolidated. A classification of railways on the basis of operated mileage shows that 44 roads, each with a mileage of over 1,000 miles, operate 100,547.29 miles of line, or 56.30% of the total mileage of the country; 23 roads, each with a mileage of over 600 and less than 1,000 miles, operate 17,918.35 miles of line, or 10.03% of the total mileage; 23 roads, each with a mileage of 400 and less than 600 miles, operate 11,724 miles of line, or 6.57% of the total mileage; 42 roads, with a mile-

age of over 250 and less than 400 miles, operate 13,508.82 miles of line, or 7.56% of the total mileage, and 907 roads, each with a mileage of less than 250 miles, operate the remainder of the mileage, 34,910.26 miles, or 19.54% of the total mileage. From this it will be seen that 90 roads, representing the first three classes, operate 72.90% of the entire mileage of the country.

The statistics of equipment of the railways of the United States on June 30, 1894, may be tabulated as follows:

Total number of locomotives	35,492
Passenger locomotives	9,893
Freight locomotives	20,000
Switching locomotives	5,085
Unclassified	513
Total number of cars reported	1,278,078
In passenger service	35,018
In freight service	1,205,169
Caboose, derrick, gravel, pay and other cars in company service	39,891
Increase in cars in year 1894	4,132
Increase in previous year, 1893	58,854
Passengers carried per passenger locomotive	62 6.9
Passenger miles per passenger locomotive	1,444,409
Tons carried per freight locomotive	31 900
Ton-miles per freight locomotive	4,016,755
Passenger cars per 1,000,000 passengers	53
Freight cars per 1,000,000 tons freight	1,888
Locomotives fitted with train-brakes in year	1,579
Cars fitted with train-brakes in year	30,383
Locomotives fitted with automatic couplers in year	1,197
Cars fitted with automatic couplers in year	34,186
Total equipment still without train brakes	74.80%
" " " " automatic couplers	72.77%

The total number of railway employees on June 30, 1894, was 779,608, a decrease of 10% on the return for the previous year, and the smallest number employed in any year since 1890. The greatest decrease has been in trackmen, the decrease in this class being 29,443, or 16.34%; the next largest decrease was in 19,890 laborers, or unclassified employees, a decrease equal to 18.91%. The total reduction in the administrative force was 3,635, while that in the maintenance of way and structures was 40,841. A new feature in this report is a table giving the average daily compensation for the various classes of railway employees. For 1894 this record stands as follows: General officers, $9.71; other officers, $5.75; general office clerks, $2.34; station agents, $1.75; other station men, $1.63; enginemen, $3.61; firemen, $2.03; conductors, $3.04; other trainmen, $1.89; machinists, $2.21; carpenters, $2.02; other shopmen, $1.69; section foremen, $1.71; other trackmen, $1.18; switchmen, flagmen and watchmen, $1.75; telegraph operators and despatchers, $1.93; employees on floating equipment, $1.97.

The total amount of reported railway capital on June 30, 1894, was $10,796,473,813, or $62,951 per mile of line. This is an increase in the amount outstanding during the year of $290,238,403. The amount of capital stock was $4,834,075,659, of which $4,103,584,166 was common stock, and $730,491,493 was preferred stock. The funded debt was $5,356,583,019, classified as follows: Bonds, $4,593,931,754; miscellaneous obligations, $456,277,380; income bonds, $242,403,681, and equipment trust obligations, $63,970,204. The amount of current liabilities was $605,815,135. The amount of railway securities held by the railways as an investment was $1,544,058,670, a decrease during the year of $18,963,563.

The amount of stock paying no dividend was $3,066,150,094, or 63.43% of the total amount. Of the stock-paying dividends, 4.31% of the total stock paid from 4 to 5%; 10.12% paid from 5 to 6%; 5.12% paid from 6 to 7%, and 5.42% paid from 7 to 8%. The total amount of dividends was $95,575,976, or an average rate on the dividend-paying stock of 5.41%. The amount of bonds paying no interest was $650,573,789, or 14.17%. The amount of miscellaneous obligations paying no interest was $53,426,264, or 11.71%, and the amount of income bonds paying no interest was $210,757,554, or 86.94%.

The public service rendered in the year was as follows:

Total passengers carried	619,088,199
Increase over previous year (with World's Fair travel)	26,127,587
Passenger mileage	14,289,445,843
Average passengers per train	44
" distance for each passenger	23.06
Passenger mileage per mile of line	81,333
Tons of freight carried in 1894	638,186,553
" " " " 1893	745,119,482
Ton mileage for freight	80,335,104,702
Decrease from 1893	13,253,007,131
Ton-miles per mile of line	457,252
Average tons in a train	179.80
" haul of one ton, miles	125.88
Gross earnings	$1,073,361,797
Decrease from 1893 (12.07%)	147,391,077
" in passenger revenue (5.35%)	16,142,258
" " freight " (15.63%)	129,532,948
Total operating expenses in 1894	731,414,322
Decrease from 1893 (11.06%)	90,500,977
Net earnings	341,947,475
Income from outside sources	142,816,835
Fixed charges and other deductions	429,008,310
Net income for 1894 (dividends)	$55,755,970
Dividends actually paid	$95,575,976

The last statement is especially significant, as it shows that nearly half the dividends paid were paid with borrowed money or out of previous years' earnings, and so were not really earned. Of the gross earnings, 26.58% was from the carrying of passengers, and 65.16% came from freight.

During the year 1,823 railway employees were killed, and 22,422 were injured, as compared with 2,727 killed and 31,729 injured in 1893. This decrease is, of course, mainly due to the reduced number of employees and the decrease in the volume of business handled. The number of passengers killed was 324, an increase of 25 over 1893, and 3,304 passengers were injured, a decrease of 195. Among the fatal casualties to railway employees, 251 were due to coupling and uncoupling cars, 439 to falling from trains, 50 to overhead obstructions, 145 to collisions, and 108 to derailments. One employee was killed out of every 428 in service, and one was injured out of every 33. On the other hand, 1 passenger was killed for every 1,912,618 carried, or for each 44,103,228 miles traveled, and 1 injured out of each 204,248 carried, or for each 4,709,771 miles traveled.

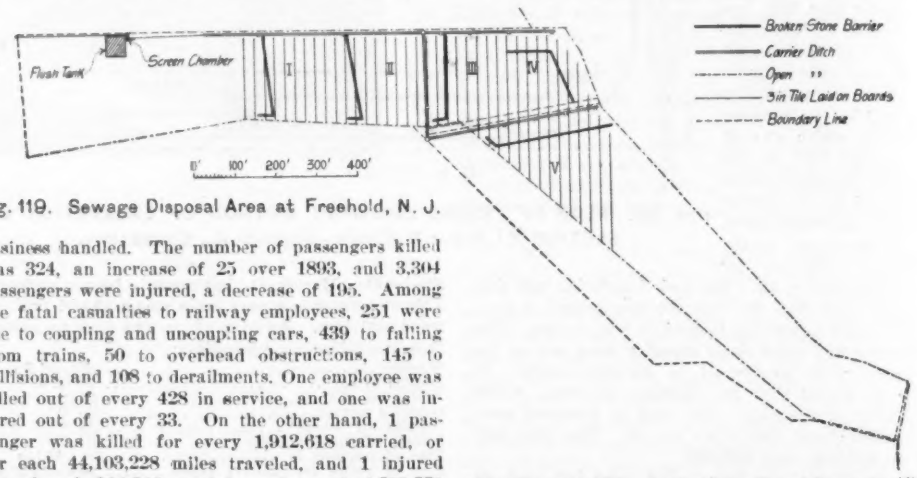


Fig. 119. Sewage Disposal Area at Freehold, N. J.

SEWAGE PURIFICATION IN AMERICA.

(Continued from p. 387.)

Broad Irrigation at Freehold, N. J.

Freehold presents a good example of the way in which a small municipality can sometimes overcome seemingly great natural obstacles to the proper disposal of its sewage. The town is small and of slow growth, having increased from a population of 2,432 in 1880 to only 2,932 in 1890. Water-works, built by the town, were put in operation in May, 1891, the supply being pumped from artesian wells to a stand-pipe. A sewerage system of the separate type was built in 1892-3, the disposal area being put in use in June, 1893.

The plans for the sewerage system were made by W. H. Chapman, of Waring, Chapman & Farquhar, of Newport and New York. The information in relation to the disposal area directly following is abstracted from a description of the same by Col. Geo. E. Waring, Jr., M. Inst. C. E., published in the report of the New Jersey Board of Health for 1893.

Land disposal at Freehold had been decided upon by the town before the engineers were called in, there being no available stream into which crude sewage could be discharged. The engineers agreed with the authorities upon this method of disposal. The only tract to which the sewage could be conveyed by gravity was somewhat unfavorable in character, much of it being peaty, "with a surface of from 6 to 12 ins. of bog-iron ore." The balance of the 16 acres selected is greensand marl and clayey gravel.

The land was naturally very wet, and had been partially drained. The first work to be done was to underdrain the area upon which sewage was to be put in the near future. This was effected by means of 3-in. tile drains laid on 8-in. hemlock boards 4 ft. below the surface. The joints were wrapped with muslin and the tiles were covered to within less than a foot of the surface with material excavated from the brook into which the underdrains discharge. This brook was lowered to a depth of 4½ ft. The underdrains are about 25 ft. apart, and are shown on the accompanying plan, Fig. 119. This plan shows the land bought by the city and the portion of it laid out for use. After laying the tiles the area was graded.

The outlet sewer discharges on two horizontal screens (each about 4 ft. square), made in duplicate for removal in cleaning, and lifted by a differential pulley on a traveler. The screen chamber adjoins and discharges into an open tank 50 ft. square and 4½ ft. deep. From this tank the sewage passes through a vertical screen to a 6-in. automatic Rhoads-Williams siphon. The siphon was adjusted at the start to discharge 22,000 gallons, but can be arranged to discharge 50,000 gallons at a time. The discharge of 22,000 gallons takes 80 minutes. The sewage can be drawn out through a 12-in. valve, independently of the siphon, and in addition there is an 8-in. high level outlet to serve an area above the siphon outlet.

The sewage flows to the different sections of the field through 15-in. half pipes, all as shown in Fig. 119, taken from Colonel Waring's description, mentioned above. The branch carriers are of concrete, and lead out from shallow, circular distributing basins of the same material, fitted with flat cast iron gates. Broken stone barriers are provided, as shown, to insure an even distribution of the sewage over the whole width of the field. The barriers are 2½ ft. wide and 8 ins. high, and serve their purpose without ponding the sewage. The field has a slope of about 1 to 175. The area was designed with the idea that each of the five sections should receive the entire sewage of one day, which would give the area four days of rest.

The sewage tank was built by contract by Mr. Andrew MacDowell, of Freehold, for $1,246; the field was prepared and fenced in by day labor under the direction of Mr. N. J. Conover, of Freehold, for $6,207; engineering and superintendence cost $1,944, making the cost of construction $30,228. All the land, including right of way, cost $4,120, of which not over $2,000 is chargeable to the area thus far prepared for use (about seven acres). The total cost of the pipe sewers built in 1892, 6.18 miles, was $20,832, or 64 cts. per lin. ft. This work included 19,583 ft. of 6, 8,602 of 8, 2,228 of 10, 1,269 of 12, and 927 ft. of 15-in. pipe; also 103 hand-holes, 77 inspection pipes, 31 manholes and 27 flush tanks.

The following information regarding the operation of the disposal area is taken from a letter addressed to Engineering News on May 30, 1895, by Mr. John Enright, Secretary of the Sewer and Water Board:

In reply to your inquiry as to the working of our sewer plant, I would say: From our former statement to you, you understand that we have the separate system, and the sewage is disposed of by irrigation. It has now been in operation two years, and everything that was claimed for it has been realized. Our disposal field is naturally the worst that could be possibly had for the work of purification, having in it so much bog iron ore and peaty material. Yet, from a sanitary point of view, which, of course, is the main one, everything has been entirely satisfactory.

In winter it works just as well as in summer. Being a very low, boggy soil over the field, it has heaved during the winter a great deal. This kills the grass, which gives a very ragged appearance to the fields. Then, too, the decaying of the vegetable matter in the soil causes depressions at places, throwing the field from its original grade. This causes a more than or-

dinary amount of sewage to be distributed to these low places. Notwithstanding all this, the sewage is taken care of in good shape. I cannot at any point in the field detect an odor one-half so bad as from an ordinary water-closet (outside surface privy?).

On June 14, 1895, a member of the editorial staff of this Journal visited the Freehold disposal area. A heavy rain had fallen on the preceding day, but the day of the visit was quite warm. Notwithstanding the saturated condition of the soil and the fairly high temperature of the atmosphere on that day, no unpleasant odors were noticed in walking around and across the disposal area. Close by the sewage receiving tank there was the characteristic odor of fresh sewage, a somewhat musty smell, suggesting the waste water from laundry tubs—a suggestion doubtless aided by the soap-suds appearance of the sewage.

Mr. W. B. Duryee, Chief Commissioner of the town, accompanied the writer to the field, and supplemented observation by some statements regarding the disposal area, which are embodied in what follows. The town bought 16 acres of land at $250 per acre, a price probably much in advance of what the land would have brought at an ordinary sale. The deed prohibits the application of sewage to that portion of the land 1,000 ft. from the upper line, the former owner of the land still holding land above this line, and thinking it for his interest to have this provision in the deed. The tract is about 1,000 ft. from a considerable number of houses, mostly single houses occupied by lease, and some 2,000 ft. from a factory which employs a number of hands. An inquiry of a citizen of the town in a position to hear any adverse criticisms elicited the statement that the people of Freehold are well satisfied with this method of sewage disposal, and make no complaints against the sewage field.

The receiving tank is emptied and cleaned about once a week. The sludge is, in part, at least, composted. The underdrains for a small portion of the lower end of the field have become so badly clogged, perhaps by roots, as to throw this area out of use. They will be dug up soon. The sunken spots, mentioned in Mr. Enright's letter, will be filled in to grade this summer. The sewage carrier is also out of grade in a number of places. Trouble has been experienced with a burrowing animal, similar to a rat, but said to be not a mole. This animal forms underground channels, through which the sewage flows laterally, instead of passing downwards. Where discovered, the animal is drowned out.

The disposal area was sowed to Hungarian grass the first year. The standing crop was sold to a farmer for $45, but molded after being housed. Mr. Duryee stated that an attempt to cure the grass the second year also failed, and that it is rank and green, like a crop intended for ensilage. This suggests the possibility of preserving the grass by means of silos.

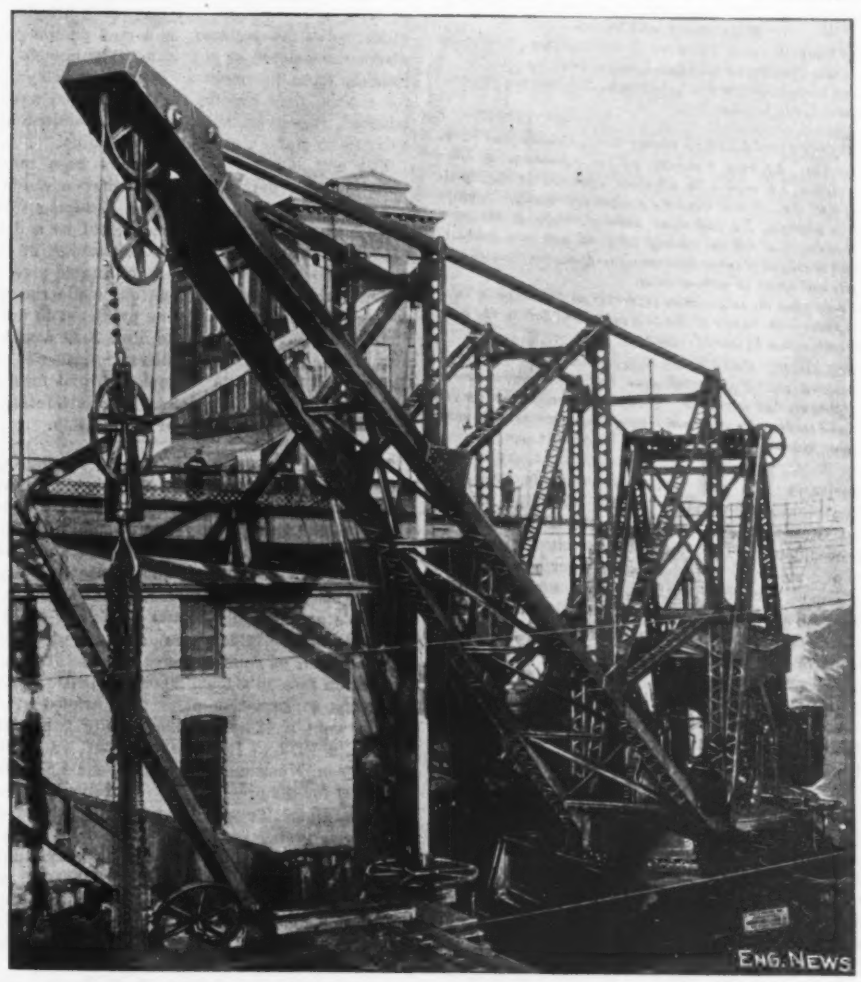
A laborer is employed on the sewage field the year around at $25 a month. The superintendent of the sewers and water-works, Mr. S. Perrine Voorhees, has raised some crops on the portion where the application of sewage is prohibited. This year a garden tract is in successful cultivation, and quite a field of potatoes is coming on in a rather backward condition, perhaps due to late planting. No objection is made to occasional applications of sewage to these crops, and this is sometimes done.

Mr. Voorhees informs us that there were on June 18 about 265 connections with the water-works, of which two are railways, three factories and five schools. On the same date the number of sewer connections was 150. The average daily water consumption since April, 1895, has been about 96,000 gallons. About 72,000 gallons daily is now discharged at the sewage farm, of which some 9,000 gallons is from 22 flush tanks, which discharge about 420 gallons each per day.

The land, it may be added, is outside the limits of the town, and within those of the township of Freehold. This made necessary, according to recent New Jersey legislation, the permission, which was obtained, of the township before the land could be used for sewage disposal. The brook into which the underdrainage flows discharges into the Monasquan River, which rises southwest of Freehold and flows southeasterly 17 miles to the sea.* The average flow of this stream at Upper Squam, the head of tide, is 67,300,000 gallons, and its minimum flow is 10,900,000 gallons daily.

FORTY-TON SELF-PROPELLING CRANE FOR MARE ISLAND NAVY YARD.

We illustrate herewith a 40-ton traveling crane recently constructed for the United States Government navy yard at Mare Island, Cal., by the American Hoist & Derrick Co., of St. Paul, Minn. This crane is designed to travel on a track running along each side and around the head of the dry dock at the navy yard, and is to be used in handling the machinery and material for repairs into and out of vessels docked there. In addition to being an unusually large machine, the crane is novel in several particulars of its construction.



FORTY-TON TRAVELING CRANE FOR THE DRY DOCK AT MARE ISLAND NAVY YARD.
The American Hoist & Derrick Co., St. Paul, Minn., Builders.

The general appearance of the crane is quite clearly shown in the illustration. As will be seen, the trussed boom is carried on a turntable, which in turn is supported by a heavy steel car. This car runs on 18 double-flanged wheels, having a 20-ft. gage. Two of these wheels are driving wheels and all are so geared that the outside wheels automatically increase their speed in going around the curves at the head of the dock. These curves have radii of 66 ft. The car body is 24 ft. wide and carries at its rear end a 120-ton counterweight of cast iron. The track on which the car is to be run will be laid with 100-lb. steel rails, supported on timbers resting on piling.

On the top of the car is the roller track of the turntable. This track is 22 ft. in diameter and carries the 50 steel rollers on which the turntable drum travels. This drum is revolved by means of a steel pinion meshing into rack 25 ft. in diameter. The 8 × 12-in. double cylinder engine for operating the crane stands on the drum. This engine operates a horizontal shaft running transversely across the drum. From this shaft the power is taken by means of friction clutches for raising the load, turning and running the crane, and driving the sprocket chain, which runs to the gearing seen in the view over the center of the turntable. This gearing is for the purpose of operating the screws which raise the outer end of the boom, by shortening the top chord, thus bringing the hoisting block in toward the drum. The radius of the boom may be varied between limits of 60 ft. and 75 ft. by this movement.

The construction of the boom is simple, it being made up of latticed channel struts, plates, and eye-bars. To permit of the upward movement just mentioned, the support of the boom on the drum is of course pivoted. The hoisting block and sheaves are clearly shown in the illustration, as is also the location of the hoisting drum. The hoisting rope is of steel 1 5-16 ins. in diameter, and has an ultimate strength of 76 tons.

All the motions of hoisting, turning and traveling can be performed simultaneously. The traveling speed is 50 ft. per minute, the hoisting speed, with a 40-ton load, 7 ft. per minute, and with a 15-ton load, 15 ft. per minute, and the turning speed is two minutes for a complete revolution. When the boom is elevated to its higest point it is 54 ft. high.

The crane was successfully tested March 2, and is now being taken down for shipment to the navy yard. The contract price for the crane was $50,000. The total weight of the material to be shipped is 300 tons, and this does not include the counterbalance weight. We are indebted to the American Hoist & Derrick Co., the builders of the crane, for the photograph from which our illustration has been prepared. It is a matter worthy of especial notice that a contract for such a large and heavy machine should be taken by a firm located so far west of the principal centers of iron manufacture.

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Americans may well feel national pride over the excellent impression made by the warships of the United States at the opening of the Baltic Canal. That occasion brought together the most powerful fleet of modern war vessels ever congregated in one harbor; in fact, the most powerful war fleet ever gathered anywhere, at any time. Eight nations were represented by 51 warships, with the best and latest models of each class. Germany alone had 14 battleships in line, and England and Italy each had four. The heaviest and fastest battleship belonged to the latter nation, the "Sardegna," of 13,800 tons and 19 knots of speed. But while the United States sent no ships of this class, she was well represented by the "Columbia," one of the three triple-screw cruisers of the world; and the fastest cruiser afloat, with a speed record of 22.8 knots, and holding the record for the fastest voyage by a war vessel across the Atlantic. In the "New York" this country divided the honors with the Spanish "Maria Teresa" for the fastest armored cruiser afloat; and, according to ex-Secretary of the U. S. Navy, Gen. B. F. Tracy, who was present, the consensus of opinion was that the "New York" was the best of her class in the world, having a heavier battery and being more economical of coal, and thus having a greater effective radius of action. Russia had, in the "Rurik," the largest armored cruiser afloat, with 10,923 tons, against 8,150 tons for the "New York" and 9,000 tons for the English "Blenheim." But in power and speed these three boats compared as follows: "Blenheim," 20,000 I. HP., 22 knots; "New York," 16,500 I. HP. and 20 knots, and the "Rurik," 13,558 I. HP. and 19 knots. Taken altogether, the "new navy" of the United States did full credit to our naval architects and engineers and to American shipyards, and the results of their good work were fully appreciated by the best judges of warships in the world.

So long as communities continue to drink their own and their neighbors' sewage in their water supply, it is to be expected that typhoid fever will sweep away its thousands of victims every year. For the most part the work of this preventable disease is done stealthily, and attracts little or no attention, but now and then an epidemic arises which spreads alarm throughout a city. According to press reports, the city of Evansville, Ind., has just been aroused to the dangers of a polluted water supply. It is stated that one of the city sewers discharges into the river above the intake of the city water-works. In April, 1895, out of a total of 79 deaths in the city, 14, or 18%, were caused by typhoid fever, and in May, 18 out of 61, or nearly 30%. The situation became so serious that a citizens' committee of 25 was appointed to co-operate with the Board of Health.

The city authorities have recognized the necessity of obtaining a new water supply, but appear to be hampered by lack of funds. Two or three years ago they attempted to solve the problem by that method so alluring to some city officials, the offering of prizes for the best plan for a new supply. A number of plans were submitted, but pure water, until the recent epidemic, has been no nearer than before. Now that the people are thoroughly aroused, perhaps some means will be devised to effect an improvement in the present supply, if one cannot be brought in from a new source. A temporary filtering plant might solve the problem, or a new pumping station above the sources of pollution. The present intake, judging from the reports, is not suitably located for a permanent supply, even if filtration were to be adopted, the river being so much polluted at that point as to make a new source desirable.

The city officials seem to have been impressed with the idea that infiltration galleries would be a happy solution of their problem. Judging from the experience of other cities this would be a doubtful expedient, especially for a community of 60,000 people. Such galleries almost invariable give diminishing yields as the years go on, while the quality of their effluent can hardly be predicted in advance, at least not favorably. Sand filter beds would probably be far preferable to infiltration galleries, where disease germs were to be removed, and mechanical filtration should also be taken into consideration before adopting any method of purification.

The subject of filter beds naturally brings up the question as to whether or not they should be covered. This matter is now being considered at Poughkeepsie, where the European system of sand filtration was first introduced on a large scale in this country. These beds were built at the same time that the water-works were constructed, in 1870, and have an available area of only 29,400 sq. ft., or 0.675 acre. This was the original area, and still does all the work, which, of course, increased, for although the population rose only from 20,080 in 1870 to 22,206 in 1890, the consumption more than tripled after the works were well started, increasing from 500,000 gallons in 1872 to 1,680,000 in 1890. In 1893 the average daily consumption was about 1,830,000 gallons, and for the present year it is probably about 2,000,000 gallons. These figures being yearly averages, convey no proper idea of the work the filters are sometimes called upon to do, for the maximum consumption is much higher. But at 2,000,000 gallons a day the beds would be filtering the year around at the rate of about 3,000,000 gallons an acre, allowing no time for cleaning, when half of the area is out of use. Bacterial analyses made in 1891 and 1892, under the direction of Prof. T. M. Drown, showed an average removal of 91.48% of bacteria by filtration, with a minimum of 82.1 and a maximum of 97.9%. Prof. Drown stated at that time that the filters were greatly overtaxed, and that "they should have twice their present area to bring down the rate of filtration to the standard of good practice." Mr. Chas. E. Fowler, Superintendent of the city water-works, urged in his report of 1893 that the filters should be increased in area, or else the present bed should be covered. The reason given for the latter course was that "the beds cannot be cleaned during a storm of rain or snow or freezing weather." If a storm comes up while the beds are being cleaned work must not only stop, but sometimes it must be done over again, Mr. Fowler states.

The matter is now under consideration by the city authorities. Some of the officials wish to cover the present filter beds, while others claim that such a course would be a waste of money since the beds must soon be enlarged anyway.

The probabilities are, however, that the present beds could be covered to advantage in any event. Mr. Allen Hazen, in his "Filtration of Public Water Supplies," just published, advocates the covering of beds in all localities where the normal mean January temperatures are below the freezing point, or where algae growths give trouble. Poughkeepsie comes under both classes, and in addition, according to the "Eagle," of that city, leaves on the beds give trouble in the fall.

The situation is further complicated by the fact that the present beds, built to be water-tight, have developed some serious leaks which should be repaired at once, but cannot, Mr. Fowler states, unless they are thrown out of use for two or three months.

The outcome at Poughkeepsie will be watched with interest. As the pioneer of scientific sand filtration in this country the city has at stake not only its own reputation, but to a certain extent that of the system which has served it so well for a quarter of a century. This system is a pronounced success under proper conditions, as other plants in this country are demonstrating, and after having once been a leader in this matter it is to be hoped that Poughkeepsie will keep pace with modern ideas, supply the necessary conditions and reap the results which will follow.

THE PREVENTION OF BOILER EXPLOSIONS

On Nov. 2, 1893, a steam boiler in the stables of the Dry Dock, East Broadway & Battery Street Ry. Co., on East Fourteenth St., New York city, exploded with sufficient force to entirely wreck the building in which it was located, and caused the death of five persons and the serious injury of twelve others. A full account of the disaster was published in our issue of Nov. 9, 1893, and it was shown that the explosion was caused by external corrosion, reducing the thickness of the dome sheet of the boiler to such an extent that it gave way under the strain imposed upon it.

A suit was recently brought to trial in which the relatives of one of the men killed claimed damages from the railway company which owned the boiler, but the jury returned a verdict for the defendant, holding apparently that it had exercised usual and reasonable care to keep its boiler in a safe condition, and that it was not responsible for a disaster due to a defect which was not readily discoverable, and which was doubtless unknown to its owners. It is of interest to consider what is the reason or unreason in such a verdict, and growing out of that the broad question: What are or what should be the responsibilities placed by law upon the owners of steam boilers.

Every legal code ever made has recognized in some degree the responsibility of the owners of "instruments of danger." In the Mosaic code the owner of an ox which gored a person with its horns was held responsible, provided it was shown that the ox had previously been of an unruly disposition, and that its owner was aware of the fact. The law at the present day is not dissimilar to this, save that the tendency is more and more to lay upon the owner the responsibility for the condition of any "instrument of danger" which he may possess. It is agreed on all sides that the owner of a steam boiler is bound to use reasonable care to protect the public (including his employees) from injury by it, and that he is responsible to any one suffering injuries arising through lack of such care.

The question turns, then, simply on what interpretation shall be placed on the words "reasonable care." What precautions is the owner of a steam boiler bound to take to secure the safety of those who are or may be in its vicinity? To answer this question properly, a comprehensive view of the history of boiler construction and operation is essential, for in the eyes of the law, custom sanctions some things which would be condemned by the most advanced engineers. A man is not legally bound to use the most recent and improved appliances for securing safety, but only those which have had their merits proved by a somewhat general adoption.

Doubtless the most important principle to be laid down at the present time in discussing the responsibility for boiler explosions is that they do not occur except from known causes. In other words, while the belief that boiler explosions are frequently due to some mysterious, undiscovered agency still survives in the popular mind, the engineering profession as a whole has definitely dis-

carded the old hypotheses of "electric action," "formation of explosive gas," "water in the spheroidal state," and other pseudo-scientific theories, which have at one time or another been put forward to explain steam boiler explosions.

The bearing of this upon the responsibility of steam boiler owners is evident. If a boiler explodes from some unknown and mysterious cause, no blame, legal or moral, can attach to its owner. If, on the other hand, the explosion is due to well-known and easily-discoverable causes, it is equally plain that it is the owner's duty to see that no such causes become operative, and that a proper watch is kept to discover and remedy them if they occur.

And now the question arises, What does the record of experience show with respect to the discovery of defects in boilers by inspection? Does inspection prevent boiler explosions? We believe it may be safely laid down as the general verdict of the engineering profession that a proper and thorough inspection is an efficient safeguard against boiler explosions. We do not mean by this that inspection can secure absolute safety. Safety is really a relative and not an absolute term, anyway; and it is manifest that since inspection depends on the vigilance, skill and fidelity to his trust of the inspector, the occasional instances of incompetence or corruption which may occur diminish by so much the degree of safety that inspection secures. A very plain distinction must be drawn also between a thorough inspection, such as a reputable boiler insurance company gives, and a perfunctory inspection, such as is not infrequently given where the duty of inspection is entrusted to the engineer or fireman in charge of the boiler or to some local machinist. The boiler whose explosion we described at the outset of this article had been regularly inspected by the New York city police department; yet a portion of its shell had been corroded to a thickness of less than ⅛ in. when the explosion occurred. So there are a multitude of instances of glaring and dangerous defects being overlooked when the examination was left to the person in charge of the boiler or to some one not trained and experienced in boiler inspection.

On the other hand, the records of boiler insurance companies show that an experienced and faithful inspector will almost invariably discover weaknesses or defects in time to prevent disaster. The Manchester Steam Users' Association, in England, which was established in 1854, has some 5,000 boilers under its care, and up to 1892 no loss of life had ever occurred from a boiler inspected and guaranteed by the Association. The Association is a mutual insurance company, operated on the principle of preventing losses by competent inspection.

In this country such long-established concerns as the Hartford Steam Boiler Inspection & Insurance Co. have so systematized boiler inspection as to make it an almost perfect safeguard against explosions. In 1893 this company's inspectors examined 163,328 boilers, and discovered 122,893 defects, of which 12,390 were classed as dangerous. Of the total number of boilers inspected, 597, or about 1 in 300, were found unsafe for further use.

One of the most interesting evidences as to what engineering progress has done in diminishing the dangers due to steam boiler explosions was furnished in the course of a recent discussion on the subject of boiler explosions before the Institution of Civil Engineers. The paper itself was little more than a resume of the general subject of boiler explosions and of the causes to which they are due; but one of the speakers in the discussion presented the statistics of boiler explosions in the United Kingdom for 35 years in the form of diagrams, and we reproduce them herewith. To understand the full significance of the astonishing reduction in the loss of life and property by boiler explosions which has taken place during the period shown in the diagrams, we must remember that the figures show the actual number of deaths and casualties, and not the percentages of fatality. We know, of course, that the number of boilers in use has increased enormously in this time, and that the steam pressures carried have been doubled, trebled and quadrupled. And yet notwithstanding the fact that there are perhaps four times as many boilers at work now as 20 years ago, and that the pressures are so much higher as to make an explosion, when it does occur, much more disastrous, the figures show that the death and damage wrought by boiler explosions have been reduced from an appalling figure to an insignificant one. We can recall no better testimony to the strides which engineering has made during the past third of a century than is afforded by these little diagrams.

In examining the diagrams giving the number of explosions, it will be seen that the collapses of land boilers were not included in the first years which the diagram covers, and not until the passage of the Boiler Explosions Act, in 1882, were disasters to steam digesters, driers, economizers, and similar machinery included with those of steam boilers proper.

The engineer who presented these diagrams in the discussion, Mr. Michael Longridge, also gave statistics which showed still more conclusively the value of inspection as a means of preventing boiler explosions. We may summarize these figures as follows:

Total number of boilers in Great Britain (estimated)	140,000
Total number of boilers in Great Britain which are inspected by boiler insurance Cos. (est'm'd)	70,000
Total number of boiler explosions in 11½ yrs.	696
Average number per annum	60.5
Total deaths from boiler explosions in 11½ yrs.	314
Average number per annum	27.3
Explosions of insured boilers in 11½ years	104
Average per annum	9
Deaths from such explosions	65
Average per annum	5.7

It will be seen from the above that if the estimate of the number of boilers be taken as correct, one uninsured boiler in 1,360 exploded annually, and one death occurred per annum for each 3,240 uninsured boilers. On the other hand, only one out of every 11,000 insured boilers exploded per annum, and one death occurred for every 14,600 such boilers.

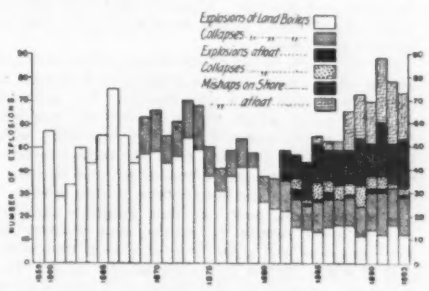


Diagram Showing Number of Boiler Explosions in Great Britain During 35 Years, 1859-1893.

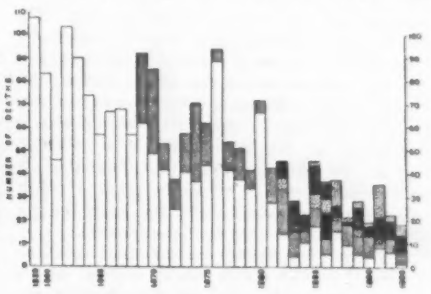


Diagram Showing Number of Deaths from Boiler Explosions in Great Britain During 35 Years, 1359-1893.

But even these figures do not fully represent the safety which is attainable by a thorough system of inspection. The insured boilers in the above table include, of course, the boilers insured in all the different companies, and it is well known that in the competition between the different companies for business there is often a tendency to accept boilers not in first-class condition, and cover the risk by an increased premium.

It is to be regretted that no similarly complete statistics as to boiler explosions in the United States are available. The matter is one which is naturally left to the separate states, and the few which have enacted any laws relating to the subject have, so far as we recall, made no provision for the collection of statistics of explosions. A record made up from newspaper reports, and necessarily very incomplete, has been kept for some years by the Hartford Steam Boiler Co., and shows that from 200 to 300 boiler explosions occur annually in the United States, causing about the same number of deaths, and from 300 to 450 injuries. From this record, with other information, it is probably safe to say that boiler explosions are more common in this country than in England. British steam users have been greatly educated in their responsibilities by the operation of the Boiler Explosions Act, and the inquiries into the causes of explosions held by the Board of Trade.

It may well be queried, too, whether the internally-fired Cornish and Lancashire boilers, which are the boilers in most extensive use in Great Britain, are not, on the whole, safer than the externally-fired return tubular boiler, which is the typical American boiler. In any boiler of cylindrical form the shell must, of course, sustain the strain due to the internal pressure. In the externally-fired boiler, this shell is subjected to the direct action of the fire, and any impediment to the transfer of heat to the water in the boiler, such as the collection of sediment or scale, results in the overheating and weakening of the shell. In the British boiler, on the other hand, the shell itself is subjected to no heat, unless it be the moderate heat of the flue gases just before their final exit from the boiler. Experience shows that dirt, scale, etc., are much less likely to collect on the convex upper surface of the furnaces and flues in an internally-fired boiler than in the concave lower part of the shell which is exposed to the direct action of the fire in an externally-fired boiler.

And there is another possible reason for superior safety in the Cornish and Lancashire boilers. Study of the graphical records of British boiler explosions which are given herewith inclines one to the belief that it is to improved care and inspection, rather than to improved construction, that the wonderful decrease in boiler explosions has been due. The design of the boiler has seen little change in this time; the material used, if we may believe those who tell of the qualities of old-fashioned wrought iron, has been improved little, if any. The pressures under which steam is worked we know to have been enormously increased. It seems wholly reasonable, therefore, to conclude that to better management, rather than to better construction, the improvement we have noted is due. But the typical British boiler can be much more readily subjected to thorough inspection than the typical American boiler. It needs hardly be said that thorough inspection includes careful internal examination, and an inspector can, of course, get about much more easily inside a one-flue or two-flue boiler than he can in an American multi-tubular boiler.

On the other hand, American practice is far in advance of the practice in Great Britain in the use of sectional or water-tube boilers. There are now several thousand boilers of this class in operation in this country, and experience has shown that such boilers do not explode. Failures do occur of the tubes and other parts of such boilers, resulting in an outrush of steam into the boiler room, and serious and sometimes fatal injury to its occupants; but, so far as our information extends, no case is on record where a water-tube boiler has been torn in pieces, wrecking the building containing it, and causing death and injury to those in the street or in neighboring buildings. With any boiler of the shell type, however, such disastrous explosion is always possible, although the likelihood of its occurrence may be reduced to an infinitesimal amount by a proper system of inspection. For this reason the use of boilers of the water-tube type is coming to be considered essential for the public safety in all places where an explosion would injure important structures or affect large crowds of people. Their adoption for the power plant at the Chicago Exposition is a case in point, and the best engineering practices at the present day undoubtedly dictates the use of such boilers in office buildings, school buildings, etc., and even in large factories where the boiler plant is adjacent to buildings where a large number of operatives are at work.

And now, in view of the facts above laid down,

what may we define as that reasonable care which the steam user is bound to take with reference to his boiler, and failing which he becomes financially responsible to any one suffering injury?

He is, in the first place, bound to exercise proper care in selecting a safe type of boiler, and what is considered a safe type depends upon the state of the art at the time the purchase was made. No one could be considered in any way culpable for not installing a sectional boiler a dozen years ago. Many engineers at the present day, even, would consider the use of an ordinary externally-fired boiler under an office building or apartment house to be justifiable. But the tendency is more and more toward the adoption of a boiler of safer construction; and there can be little doubt that eventually the man who, to save the very few dollars' difference in first cost, adopts a shell boiler instead of a sectional boiler, where a large number of lives are at risk, will eventually be held legally responsible for his choice. On the other hand, for location in a boiler house standing at a considerable distance from other structures, it is doubtful whether the use of sectional boilers will ever be considered incumbent upon the owner. It is not entirely certain that a much greater measure of safety is secured to the men employed about the boiler by the sectional boiler than by the shell boiler, each being supposed to be properly inspected.

But supposing a boiler already installed and in operation; are there circumstances under which it would become the duty of the owner to remove it and replace it with a boiler of a safer type? The answer to this question will depend manifestly upon the degree of danger to which the public is subjected by the continued use of the boiler. No one could be held blamable for continuing the use of any of the common types of boiler if it was in good condition; on the other hand, if a boiler in use were so defective in design that reputable insurance companies would refuse to grant a policy upon it, the owner should certainly bear the responsibility if he chooses to continue its use.

But of greater importance by far than the type of boiler used is the watch which is kept of its condition. It is the first and chiefest duty of the boiler owner to see that his boiler is properly inspected. In Great Britain, where the circumstances attendant on all boiler explosions are investigated by the Board of Trade, especial stress is laid upon the amount and character of the inspection which the boiler received in determining the responsibility of its owner.

The state of Massachusetts has just passed a law requiring the owners of boilers not inspected by boiler insurance companies to submit them to the examination of a state inspector at regular intervals, and requiring the engineers and firemen in charge of steam plants to submit to an examination as to their competency, and obtain a state license.

All this is in accord with the principle laid down at the outset of this article.

The security afforded by inspection we have fully explained above, and the manifest duty of the boiler owner to provide such inspection would seem to admit of little question. If he fails to take this precaution, he should be made to recompense those who may suffer through his neglect.

Further, since inspection possesses such importance as a means of securing the safety of steam boilers, more pains should be taken to facilitate inspection in the design of boilers and boiler settings. If a boiler is of such a design that its condition cannot be determined by an inspector, no reputable company will undertake to insure it; and if its owner then prefers to run the risk of its explosion instead of replacing it with a safe boiler, it is certainly unjust that others should have to share this risk with him. It is the owner's duty to know that his boiler is safe, and his ignorance of the fact that it was unsafe should not, and we believe does not, absolve him from responsibility.

LETTERS TO THE EDITOR.

THE KIND OF STEEL PIPE THAT FAILED AT NEW WHATCOM, WASH.

Sir: In my article entitled "Submerged Wooden Water-Works Intake Pipe at New Whatcom, Wash.," published in your issue of May 23, I referred to some steel pipe that failed and to another section that was damaged by flood. In reply to your inquiries regarding this pipe, I submit the following:

The steel pipe was No. 18 B. W. G., such as has been used extensively in California for mining and other purposes, and was probably never intended for a water supply main. The pipe was shipped here in 18 to 24-ft. lengths. The joints or connections between sections were made with cement. The cause of failure was almost entirely the cement joints. These leaks could not be permanently stopped, because the pipe was too light to stand the calking of a lead joint. The pipe was made from ordinary steel plate about 10 ins. long, bent to circular form and riveted horizontally around the circumference of the pipe. The failure of this pipe should not be taken in the least as an evidence of the inadaptability of well-constructed steel mains for water supply purposes.

The half-mile destroyed by high water in the creek was located in a dangerous place and not afterward protected in any manner. The first flood consequently took out the portion most exposed and necessitated the abandonment of all that portion between it and the intake. Yours truly, C. M. Adams.

New Whatcom, Wash., May 30, 1895.

PAINT FOR IRON WORK.

Sir: The carbon primer of the Sherwin-Williams Co., referred to in Mr. Berg's report on "Painting Iron Railway Bridges," in your issue of June 6, has been used by this company for more than ten years, with very satisfactory results. The formula from which it is made was devised by the master painter of the St. Louis Bridge & Terminal R. R., and was the result of an investigation made to determine the best covering for the iron work in the St. Louis tunnel. The carbon paint as manufactured for this company is composed of charcoal, boiled oil and litharge. Although originally intended for underground work, it has been used since 1892 for all outside structures.

The iron work in the tunnel is exposed to the combined action of moisture and sulphurous gas, which causes corrosion to take place very rapidly. The problem was to find a paint which would protect the iron surfaces from this action, and which, at the same time, would be least affected by the heat from the smokestacks of locomotives passing under a freshly-painted surface. The carbon paint gave the best results at that time.

It would seem, however, that graphite paint should give as good results as carbon, and possibly better, since graphite will stand a greater heat than the charcoal of which carbon paints are usually made. The carbon paint, as used by this company, contains no dryer; it dries with an elastic surface resembling india-rubber. The writer has cut a strip of paint from a girder in the tunnel, which had been painted six years, and this strip could be rolled into a ball between the fingers and then unrolled without cracking.

N. W. Eayrs, M. Am. Soc. C. E.
Supt. of Structures Terminal R. R. Association.
St. Louis, Mo., June 15, 1895.

A QUESTION OF AUTHORSHIP.

Sir: I beg to call attention to certain unacknowledged appropriations of matter written by myself, and originally published in my edition of "Jacob's Storage Reservoirs," by the author of the "Manual of Irrigation Engineering," published by the Messrs. Wiley & Sons.

As far as I have carried the tedious work of comparison, these appropriations extend, off and on, from paragraph 228, page 226, of the Manual, to paragraph 233, page 231, of the same. Not to quote all the instances contained within the above limits and the corresponding pages of my book, I make the following quotations from the two books in parallel columns.

Part of paragraph 228, p 226, "Manual of Irrigation Engineering":	Page 124, "Jacob's Storage Reservoirs," by E. Sherman Gould:
No rule can be laid down for the depth to which the foundations for the center wall, if one is built, should be carried. If a rock foundation is encountered, the problem is simplified, as the wall may be founded on this after removing the loose and disintegrated surface; if the test pits or borings reveal only the existence of coarse or permeable strata, the masonry core must be carried well down.	A still more important question in regard to the center wall is the depth to which its foundations should be carried. For this there is absolutely no rule, and the question must be decided according to the engineer's best judgment for each particular case. Of course, if a rock foundation is encountered, the problem is greatly simplified, for we have only to remove the loose and disintegrated surface, until we come to clean, live rock, and place our bottom course on that. The uncertainty occurs when our test pits reveal the existence of coarse and permeable strata, when our only resource is to carry our wall well down.

It may appear to some that I am making too much of a small matter, which is, after all, flattering to myself. I do not think so. Aside from the unfairness of the act, and the annoyance of seeing a garbled version of one's own words in another man's book, interlarded with remarks that one would never have written, there is this further point to be considered: Should another edition of my little volume be issued dated, say, 1896, I should then be in the absurd position of appearing to plagiarize from the author of the "Manual."

Very truly yours, E. Sherman Gould.

Yonkers, N. Y., June 11, 1895.

STEAM SHOVEL WORK ON THE DRAINAGE CANAL.

Sir: Evidently you consider that we are not entirely incapable of answering the retort which you published May 23 from the Chief Engineer of the Bucyrus Steam Shovel & Dredge Co. for the receivers, or possibly a continuation of the subject of steam-shovel work is a line of information you would invite. Their attitude in representing beyond peradventure that the drainage canal has a "corner" on all terrestrial hard-pan material ("this in harder material than any steam-shovel has heretofore worked in") is so presumptive as to discredit much else that appears with it. If it were a fact, and the numerous instances we cited which you published April 11 were all misconceptions of what hard material is, how will our friends, the B. S. & D. Co., reconcile the following fact with their sinister remarks about our shovels on the drainage canal? We furnished a shovel in 1882 to do the stripping for the limestone quarry at Lemont (a point where the canal work is described as rock), where it has been a success for a dozen years, and the letter from its users, dated July 16, 1890, says: "It has worked to our complete satisfaction, and we are satisfied that the expense of moving the material we handle is only one-fourth of what it would cost by hand labor. . . . We purchased an excavator of another make at the same time, but are much better satisfied with the results of the working of your machine."

Since they mention the failure of shovels of our manufacture, implying that we furnished them, the true inwardness of the matter should be shown. Ricker, Lee & Co. started Section F (we have understood). They "remodeled" a shovel of ours, not much, if any, under 25 years old, and put it on a car-frame, but since it "only worked one day" it certainly was not to blame for their withdrawal from that contract. On Section E we presume they refer to a shovel used by Remington & Co. S. D. Eaton's letter to us last year lets in the light on that. He says:

I rented to Remington & Co., of Chicago, our plant for two years to work on Chicago Drainage Canal. They ceased work and abandoned their contract work in January, not having earned half enough to pay for putting in order and shipping them our plant of two shovels, two locomotives, 40 cars and large pump.

The B. S. & D. Co. overlooked one of these two; they may have overlooked 20 more for aught we know. If it was due to any fault of the shovels, we can say that the shovels referred to were not less than 25 years old. Respectfully, John Souther & Co.

Boston, Mass., June 7, 1895.

THE IMPORTANCE OF TESTING ANEROID BAROMETERS BEFORE USING.

Sir: The experience of your correspondent E. S. G., on page 194 of your issue of March 21, affords a parallel to that of Mr. Edward Whymper*, who made exhaustive comparisons of aneroids against the mercurial barometer at high elevations in the Andes in 1879-80. Mr. Whymper took a number of aneroids by the best English makers, constructed specially for his expedition, and which were under trial and examination for nearly twelve months before departure to South America with him; and after some months of comparison with the mercurial at elevations ranging from sea-level to the summit of Chimborazo came to the following conclusions, amongst others:

All aneroids lose upon the mercurial barometer when submitted to diminished pressure. When diminished pressure is maintained continuously, the loss commonly continues to augment during several weeks, and sometimes grows to a very important amount. (The index errors of some of Mr. Whymper's aneroids exceeded 1 in. at camps on Chimborazo.) The amount of the loss which occurs is different in different instruments. Some lose twice or even three times as much as others. The amount of the loss which occurs in any aneroid depends (1) upon the duration of time it may experience diminished pressure, and (2) upon the extent of the reduction in pressure.

Upon return from South America, Mr. Whymper set himself to investigate the causes of this increasing index-error at low pressures, but apparently without satisfactory result. He did, however, find in the course of eleven years of testing that the errors which will probably be exhibited by aneroids during natural variations of pressure may be learned, approximately, by submitting them to artificially produced variations of pressure; but the one-hour test which has heretofore been commonly applied for "verification" is of little value, except for determining errors of graduation or the errors which will be exhibited at similar pressures in a similar length of time.

Your correspondent ascribes to imperfect testing what should, if Mr. Whymper's conclusions are ac-

* "How to Use the Aneroid Barometer." By Edward Whymper. London: Published by John Murray.

cepted, be ascribed to inherent faults common to all aneroids, the extent of which can only be ascertained by exhaustive tests equal in duration to the periods for which the aneroids are subjected to diminished pressure on work. Mr. Whymper's conclusions appear to accentuate the widely-held conviction that aneroids are not to be trusted for records of absolute pressure at high elevations, and that their use must be restricted to the determination of differences of pressure only. In this connection Mr. Whymper records that differences of level at great heights may be determined with considerable accuracy with aneroids, even when they have acquired very large index-errors.

For work in hilly country, where any approach to accuracy is sought, the mercurial barometer must accompany the aneroid, and the latter must be used solely for differences. Even then it must be used with discrimination. The effects of air temperature and of the diurnal gradient can be allowed for with considerable accuracy, but the cause and extent of what may be termed internal errors are still hidden from us. The presence of these last-named errors is only revealed by comparing the readings of several instruments; which points to the advisability of using aneroids in batteries. This assumes, as a convenient arrangement, that the mercurial standard is used in camp and aneroids in the field.

I shall be glad to learn if any readers of Engineering News can confirm or rebut the evidence afforded by Mr. Whymper's experiences; or if they can throw any light upon the growth of, and frequent changes in, aneroid index-errors at high elevations. The possibility of dispensing with the mercurial barometer on rapid work is sufficient inducement, in my opinion, for taking some little trouble in the matter.

Yours truly, J. T. M.

Shillong, Assam, April 27, 1895.

ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The twenty-seventh annual convention of the Society was held last week at the Hotel Pemberton, in Hull, Boston Harbor, Mass. Through the courtesy of Mr. Charles P. Clark, President, and Mr. F. S. Curtis, M. Am. Soc. C. E., Chief Engineer of the New York, New Haven & Hartford R. R., a special train of parlor cars was provided for the large number of members and guests starting from or going by way of New York. This train, with about 280 persons on board, left the Grand Central Station, New York, at 12 noon, June 18, and after stopping at New Haven, New London and Providence, left the main line at Attleboro and struck across for the coast, connecting with the Nantasket Branch (which is shortly to be operated by electricity instead of steam), over which it proceeded to the end of the Nantasket peninsula, landing the passengers close in front of the door of the hotel. The Society occupied the entire hotel, and as there was not sufficient accommodation for the exceedingly large number of persons in attendance, the overflow had to be located at the Atlantic House, a few miles further down the beach, special trains being run between the hotels. Much time and trouble were saved by taking up the baggage checks on the train and substituting room checks, so that on arrival no registering was necessary, but the keys were distributed and the baggage was sent up as soon as possible. Names were registered afterwards at convenience. Another notable improvement upon ordinary practice was the use of numbered buttons, in addition to the badges, these badges being issued to members only, not to guests, and a printed list being afterwards distributed giving the name of the wearer of each number. This was found to be a great convenience in identifying strangers. The Society badge was ubiquitous, being displayed on the flag over the hotel, on the menu cards and among the decorations of the parlors, etc., for which the local committee must be given credit. There were no official proceedings in the evening (with the exception of a meeting of the Board of Direction), and the large and representative gathering, including an unusual number of ladies, spent the time in social converse on the piazzas and in the parlors.

Wednesday's Session.

The first session of the Society, for the presentation of papers, was opened at 9:15 a. m., and the papers then discussed related mainly to hydraulic and sanitary engineering. The reading of abstracts and the general course of discussion were managed in a business-like way, to ensure promptness and to prevent waste of time. At the opening of the session, the secretary announced that the Collingwood Prize for the best paper written by a Junior of the Society had been awarded to paper No. 699, "The Renewal of the Channel Piers of the Cincinnati & Muskingum Valley Railway Bridge over the Scioto River," by Morton L. Byers.

The first paper presented was on "The Temperature of Lakes," by Mr. Desmond FitzGerald, an abstract of which appeared in our issue of June 13. It referred to the overturning of the water in lakes and reservoirs, caused by the changes of temperature at different seasons of the year, and reference was made to the newly invented thermophone, by which the temperatures at any depth can be read off at once on a dial at the surface, this being the invention of Mr. G. C. Whipple and Mr. Henry E. Warren, and used on the Boston water-works. In the discussion Mr. F. P. Stearns said that there is but little temperature difference between large, deep lakes and small ponds, and he referred also to the importance of removing all vegetable matter from the bed of a reservoir. Mr. Fanning said that in 1878, realizing the importance of being able to take water at different depths of the reservoir, he used an adjustable inlet for a reservoir 65 ft. deep, which inlet could easily be raised to the surface to have the strainer cleaned.

The second paper was on "Experiments on the Discharge of a 30-in. Stop Valve," by J. Waldo Smith. Mr. Kuichling pointed out that this was something new, and that the practical test of this large gate-valve showed material differences from those of small gates, as usually given in text-books. The third paper was one by Mr. Dexter Brackett on "Consumption and Waste of Water," giving statistics of water consumption as determined by meter measurement, and discussing the questions of water waste and waste prevention. He did not think that in large cities it would be practicable to reduce the waste below 15 gallons per capita per day, and could only be maintained at that low figure by the universal use of water meters, aided by leak detectors. In the discussion Mr. J. J. R. Croes stated that at his residence at Yonkers, occupied by five adults, the consumption is 37 gallons per capita per day, the water being used liberally, and he thought this a fair average consumption. Mr. John Thomson referred to the great proportion of water "unaccounted for" at Yonkers, N. Y., as given in the paper, the amount pumped averaging 85 gallons per consumer, while the meters only registered 52.3 gallons, and he referred to the case of the Engineers' Club in New York, where a large amount of the water measured and paid for had been continually running to waste through a broken pipe. Mr. Kuichling thought that in many cases where the maximum supply depends upon the capacity of the conduit, water meters may have the effect of preventing a water famine. He also thought that the maximum instead of average consumption should be given in such statistics, as showing the extreme conditions to be provided for. Mr. Fitzgerald considered that meters operated to the benefit of the consumer as well as to that of the city, and in his own case the use of a meter, without any instructions as to care in the amount of water used, had saved 40 to 50% on his bills for water. Mr. Dunham said that the amount of water escaping from the mains, before any house connections are made, amounts to about 1 gallon per minute per mile of pipe for 4 to 16-in. pipe under 50 lbs. pressure. Mr. Brackett said that the waste on old works is much greater than generally supposed. Many cases had been found where a 4-in. pipe had been broken in two, and the waste had been about 100,000 gallons per day for a year, without showing any sign on the street.

The fourth paper, "A New Weir Formula," by Mr. Charles W. Sherman, was read by title, its mathematical character making it impracticable for off-hand discussion. The fifth paper was on "The Separate Sewer System Without Automatic Flush Tanks," by Mr. F. S. Odell, pointing out that flush tanks are by no means indispensable, as has so often been assumed. Mr. Rudolph Hering said he had long held the same opinion as Mr. Odell, and had found by investigation that sewers were kept in good condition without flushing. He has recommended the use of flush tanks under certain conditions, and where the expense of water is not great, but they are of more advantage on steep than on flat grades. Mr. Darrach referred to a case where a separate system has been in use for several years without flushing, the roof water of two or three houses at the heads of grades being led into the sewer. These sewers are 4 to 12 ins. diameter, and there has been no clogging.

Mr. F. P. Stearns then gave an interesting informal talk on the new water supply system of the city of Boston, giving rise to some discussion as to the desirability of storing water for a year or more to be bleached and purified by sedimentation before being used. An instance of this is afforded by Lake Winnepeseogee, which receives many discolored streams, but whose water is as clear as spring water. Mr. Worthen said that in a project he is now carrying out it has been so arranged that the draft on the reservoir will never reduce the depth by more than 20 ft.

In the afternoon a large party went up to Boston by steamer, and were driven about the city and through the parks, visiting the Chestnut Hill pumping station, this excursion having been arranged by the local members of the Society. The party returned to the Hotel Pemberton for dinner. In the evening the President delivered his address, of which we give an abstract.

Thursday's Sessions.

At the morning session the sixth paper on the list was taken up, and was a very interesting one, by Mr. Joseph M. Wilson, on "The Philadelphia & Reading Terminal Railway and Station in Philadelphia." The station is the most recent of large terminal stations of architectural pretension in this country, and the trainshed is one of the largest of its kind, having a span of 259 ft. 8 ins. c. to c. of pins, a height of 88 ft. 3 3-16 ins. at the crown, and a length of 501 ft. 8 ins., as described in our issues of Jan. 19 and Feb. 2, 1893. The paper also described the market below the station, the cold storage and electric lighting plant, the steam heating and power plant, and other equipment. The head house cost $35.95 per sq. ft. of superficial area, or 23.1 cts. per cu. ft.; the trainshed, with substructure and foundations, cost $8.53 per sq. ft. of surface covered, and the structural ironwork of the trainshed roof cost $1.15 per sq. ft. of surface covered. Mr. C. G. Darrach gave some particulars of the cold storage plant.

The seventh paper was by Mr. J. E. Greiner, on "The Life of an Iron Railway Bridge," in which he pointed out that the life depends largely upon the relation of the actual loading to the loading for which the structure was designed, and upon the amount of intelligent care exercised in the maintenance of the structure. In regard to the former matter, the question of safety hinges upon the safe working stresses, which stresses vary from 9,000 to 15,000 lbs. in different specifications, owing to the variable allowances made for impact. He deprecated the use of wheel loads or axle loads in calculation, since such loads are indefinite and variable, and a concentration of load is prevented by the interposition of the rails and ties between the load and the girder. The faster a train crosses a short structure the better, the strains being less, from the fact that it takes time for the strains to be transferred through the members. The discussion upon this paper turned largely on the great increase in weight of locomotives during the past 20 years, to which, rather than to normal wearing out, is due the renewal of so many bridges. Mr. Geo. B. Hazlehurst said that experiments on a certain bridge showed that the deflection under an engine crossing it at 30 miles per hour was only half that observed when the engine was standing on the bridge. Mr. T. C. Clarke thought that the long life of many old bridges on the New York Central R. R. was due to the use of numerous diagonals, the loads being thus diffused instead of concentrated. Mr. Geo. S. Morison thought most bridge specifications are deficient in that they do not limit the distortion which the structure may undergo. At this point a recess was taken, in order that the members and guests might be photographed in a body.

The eighth paper was on "The Construction of the Substructure of the Lonesome Valley Viaduct on the Knoxville, Cumberland Gap & Louisville Ry.," by Mr. G. R. Tuska, describing the use of concrete piers, as described in our issue of June 13. In the discussion, different methods of getting a smooth face to concrete were described: (1) By passing a shovel down at the side of the mold, thus forcing back the stones, but this is liable to scrape off the coating used to prevent the concrete from adhering to the mold; (2) Capt. Abbott has used a face of cement mortar rammed against the inside of the mold, the face being as high as the thickness of the concrete layers, and of triangular section, about 2 ins. wide on top and 4 ins. at the bottom; (3) Mr. B. R. Green has used a Portland cement face ½ in. to 3 or 4 ins. thick, plastered on the inside of the mold before the layer of American cement concrete is filled in. Mr. Morison, referring to the employment of unskilled labor on this viaduct substructure, said that sometimes such labor was preferable to skilled labor, as it is possible to get the former to do what you want them to do. This, it may be noted, is in line with a remark recently published in regard to the employment of unskilled labor for painting bridges.

The ninth paper was by Mr. H. H. Campbell on "The Physical Qualities of Acid Open-Hearth Nickel-Steel, as Compared with Carbon-Steel of Similar Tensile Strength." He gave comparative tests of nickel-steel structural shapes made by the Pennsylvania Steel Co., and drew the conclusion that it is doubtful if nickel-steel offers such marked improvement in quality that it can be employed profitably in ordinary engineering work. Mr. Percival Roberts did not think such a conclusion warranted by the extent of the tests made. The tenth paper was on "The Manufacture and Properties of Malleable Cast Iron," by H. R. Stanford, of which an abstract was given in our issue of June 6. Particular reference was made to the use of the material for the knuckles of car couplers. There was no discussion. The eleventh paper was on "Hollow Tile Floors, Past and Present," by Mr. Fr. von Emperger, and there was no discussion. We have already given an abstract of this paper. The twelfth and last paper was by Mr. J. L. Van Ornum on "Topography on the Survey of the Mexico and United States Boundary," describing an extensive stadia survey. Mr. W. B. Landreth referred to a stadia reconnaissance survey made under Mr. E. P. North for a railway between Sinaloa and Durango, in Mexico, on which no back flagman was used, the native

rodman sticking a sapling with a piece of white paper at the hub, and then going ahead, while the transitman set up on that hub, and turned on the sapling of the hub behind as a back sight. Capt. Abbott has found stadia work very valuable for the survey of small rivers in the South, the streams being bounded by cypress swamps and overhung by brush. One boat carries the instrument and another the rod, the man in charge of the latter affixing a white rag on the brush at the spot where a sight is taken, and then going on as far as he can without losing sight of this target. The meeting then adjourned.

In the afternoon there was an excursion by rail to Plymouth, where Plymouth Rock, the Monument, the museum in Pilgrim Hall, etc., were visited, and a ride taken to the Pilgrim House by special cars of the Plymouth & Kingston Electric Railway. The return trip was made by a circuitous route, reaching the Hotel Pemberton in time for supper.

In the evening a business meeting was held, and the first business was the election of a committee to nominate officers for next year. This has always been an awkward proceeding, and an attempt was made to devise some improvement under the new constitution, but the new method seems to be in practice very little improvement upon the old method. In the first place, members from the seven geographical districts were supposed to hold a meeting in the morning to decide upon two names, to be submitted at the general meeting in the evening, but many members did not know until the evening that any such sectional meetings had been held. The balloting for the member to represent the first district was proceeded with in the usual way, but for each of the other sections it was moved and carried that one of the two names presented should be taken as the unanimous choice of the meeting, thus avoiding the tedious process of voting by seven separate ballotings, which ballotings are more or less informally and perfunctorily executed. The nominating committee for officers for 1896 is composed as follows: District No. 1, E. P. North, New York city; No. 2, W. A. Brackenridge, Niagara Falls, N. Y.; No. 3, L. Fred Rice, Boston, Mass.; No. 4, Percival Roberts, Pencoyd, Pa.; No. 5, J. D. Hawks, Detroit, Mich.; No. 6, L. W. Rundlett, St. Paul, Minn.; No. 7, G. A. Quinlan, Houston, Tex.

The subject of a new society house was then taken up, and the Secretary presented an abstract of the replies received to the circular issued by the Board of Direction, asking for an expression of opinion as to the proposed new quarters and the raising of funds for the same. There were 266 replies, of which 258 (or 98%) were favorable, and the amount tentatively promised by subscriptions or the taking of bonds aggregated $52,770. In the discussion, the question was brought up as to the practicability of joint action with other societies, but the general opinion appeared to be that it would be impracticable to secure harmonious action or to avoid disputed points as to ownership of property, management of affairs, etc., although it was thought that if the Society built a large and commodious building, it would probably be easy to induce other societies to rent quarters therein. Mr. Oberlin Smith and Mr. Cohen pointed out the advantages of a large and handsome building established as an engineering headquarters, occupied by all the principal societies and by engineers' offices, and having ample library, museum and lecture room accommodations, the societies being thus centralized, while remaining entirely independent in themselves. Mr. Wilson referred to the building which is to be erected at Philadelphia by the Franklin Institute Trust, and leased to the Franklin Institute, the institute eventually owning the entire building. This will be a 12-story structure, costing about $1,500,000. Two resolutions were adopted. The first, proposed by Capt. Abbott, was to the effect that the present building is inadequate, and that a new one should be provided. The second, proposed by Mr. Herschel, was to the effect that the carrying-out of the project should be entrusted to the officers of the Society.

Mr. Don J. Whitemore then moved that a committee be appointed to draft appropriate resolutions acknowledging the various courtesies extended to the convention, stating that he brought the subject up because he had so often seen this matter left until the last moment, and then hastily and badly carried out. The chairman appointed as such committee the four past-presidents in attendance at the meeting—namely, Mr. Whittemore, Mr. Worthen, Mr. Cohen and Gen. Craighill—the resolutions to be presented on Saturday morning. The meeting then adjourned.

Friday, June 21.—In the morning there was an excursion by steamer about the harbor, by invitation of Hon. Edwin U. Curtis, Mayor of Boston, and the Metropolitan Sewerage Commission. Stops were made to examine the pumping stations at Old Harbor Point and Deer Island, and the sewage reservoirs at Moon Island, the visit being timed so as to see the discharge of the sewage from the reservoirs, which commences at 15 minutes after high tide, and is followed by the cleaning of the reservoirs by flushing with sewage previously stored in the high level sewer. Another steamboat excursion was made in the afternoon by a large party, to visit some of the lighthouses, by invitation of Major Livermore, U. S. Engineer Corps.

In the afternoon there was also a meeting of the society, at which the attendance was very small. Mr. E. L. Corthell presented a paper recording the preliminary preparations for the organization of the International Congress of Engineering in connection with the Columbian Exposition of 1893, and describing the financial and other difficulties met with and surmounted. He also presented an analysis of the proceedings of the several divisions of the congress, the summary of which showed that 17 countries contributed 210 papers, aggregating 5,520 pages of subject matter and 864 pages of discussion, and illustrated by 480 plates. In conclusion, he referred to the great advantages of the engineering headquarters established in connection with the Exposition in bringing engineers of all countries into closer intimacy. On motion, this paper was referred to the Board of Direction, in order to have it printed in the society publications.

Mr. Corthell then presented a paper pointing out the desirability of establishing closer international relations on a permanent basis between engineers and engineering societies in all parts of the world, and gave a general summary or review of the opinions expressed on this subject by numerous American and foreign engineers and scientific bodies. He expressed the hope that the matter might be referred to the Board of Direction for consideration and for an expression of the opinion of the Society, and a resolution was passed referring the matter to the Board. The meeting then adjourned. In the evening there was a reception by the President, followed by dancing, and this entertainment was commented upon as being more sociably enjoyable, and more satisfactory in every way, than the so-called banquets of former conventions, which have frequently overtaxed the capabilities of summer resort hotels.

On Saturday, June 22, a large party went to Boston and proceeded thence to Crawford's, in the heart of the White Mountains, by a special train, furnished through the courtesy of the Boston & Maine R. R. Co. The train was made up of day cars of somewhat novel design, built by the railway company, and fitted with Pullman vestibules. The train was made up of eight of these cars and a baggage car, and the engine got stalled once a heavy grade, and later on blew out a cylinder head, causing considerable delay. The party numbered about 320, and was so large that about 50 could not find accommodation at the Crawford House, and went on to Fabyan's. On Saturday, June 22, visits were made to Mount Willard and other points of interest, and although the Mount Washington rack railway is not yet opened for the season, two special trains were run up the mountain for the accommodation of the visitors. In the evening there was an informal concert at the hotel. On Monday, June 24, the return trip to Boston was made, where the party separated, the members taking their several routes homeward.

The convention was the largest one and one of the most successful ever held, and great credit is due to the local committee for the excellence and completeness of its arrangements. The principal point for criticism, a defect chargeable to the members themselves, was the extremely limited discussion of the interesting papers presented, a fault which we have previously noted at regular meetings, as well as at conventions. There were nearly 250 members of the society in attendance, while the total number present at the Hotel Pemberton, including members and guests, was about 540, a good proportion being ladies.

THE MASTER MECHANICS' ASSOCIATION CONVENTION.

(Concluded from p. 408.)

Tuesday's Session.

The first business taken up was the reading of the report of the Committee on the Causes of the Bulging of Firebox Sheets.

Bulging of Firebox Sheets.

From the expressions and experience of the members, fairly representative in character, we are led to conclude that the principal causes of the difficulty are: (1) The accumulation of mud and scale, preventing

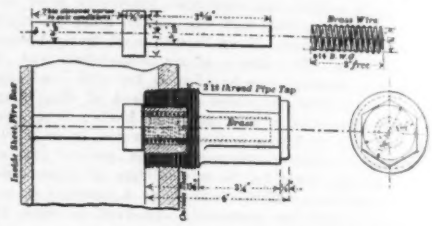


Fig. 1. Soft Lead Plug Used in Making Tests on Bulging of Firebox Sheets.

the sheet from receiving the necessary protection of the water; (2) insufficient water space, impeding free circulation, and intense heat at these points, tending to drive the water from the sheet; (3) bad water, that is to say, in addition to the general tendency of mud and scale to accumulate, as outlined above, water containing impurities and other hurtful substances, causing excessive foaming and a tendency of the water to leave the sheet and cause overheating of the plate.

One member endeavored to demonstrate whether bad water and foaming tend to cause the water to leave the sheet. A soft lead plug of the form shown in Fig. 1, which would fuse at 605° F., was held in contact with the firebox sheet by means of a spring. This plug was located about the middle of the firebox, fore and aft, and about 1 ft. above the grate. One of these was put on a ten-wheel engine running in a fairly good water district, or water that contained about 20 grains of incrusting matter per gallon, and another on a 16×24-in. eight-wheel engine, running where the water was bad, both in incrusting material and alkali. At the end of two weeks and four weeks the plug in the ten-wheel engine was examined, and no change was observed. At the end of two months the plug was reduced ¼ in. in length at the end which came in contact with the firebox. It had the appearance of having fused, and the point was upset, with a burr formed on the end. At the end of one week the plug attached to the eight-wheel engine showed no

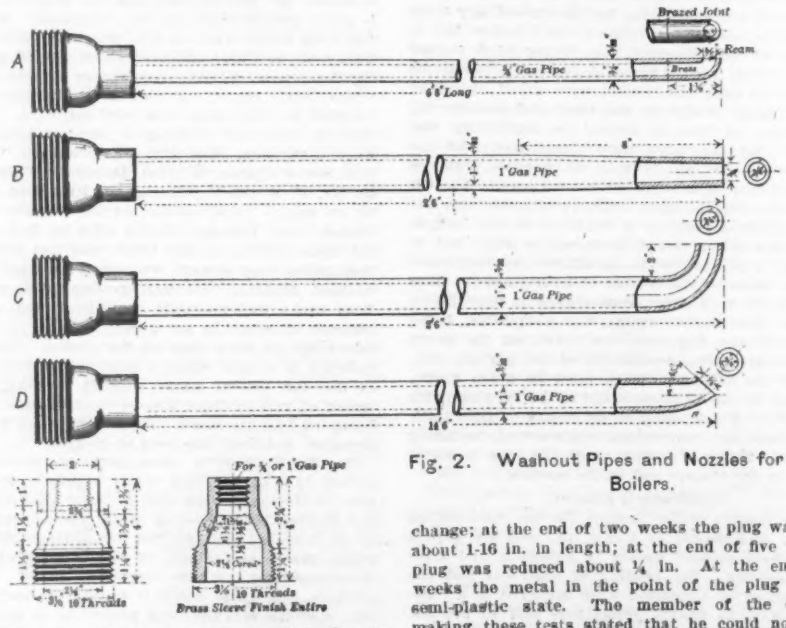


Fig. 2. Washout Pipes and Nozzles for Washing Boilers.

change; at the end of two weeks the plug was reduced about 1-16 in. in length; at the end of five weeks the plug was reduced about ¼ in. At the end of two weeks the metal in the point of the plug was in a semi-plastic state. The member of the committee making these tests stated that he could not account for the appearance of the plugs or their wasting away under any other hypothesis than that the metal at the points of the plugs reached a higher temperature than the fusing temperature of the metal. He was therefore led to think that at times the water left the sheet. Beyond this statement none of the members of the Association gave any very definite answer as to the causes of the bulging of firebox sheets.

On the question of remedies the committee confined itself to presenting statements from members describ-

ing the remedies they had found the most satisfactory. Two of these are given, as follows:

Separate the lime from the water by chemical precipitation and wash out the boiler before the precipitate shall have formed into banks and baked into sheets. In order that the best results may be obtained by chemical treatment of the water, thorough boiler washing is necessary. The mud, precipitated by chemican action, can easily be removed if reached by a stream of water. When the service will admit, the boilers should stand until steam is down before water is let out, and warm water used for washing and filling boiler. A water pressure from 75 to 100 lbs. is desirable, and when the water contains, say, 20 grains of incrusting and about the same quantity of non-incrusting matter per gallon, the boiler should be washed about every 1,000 miles, and more frequently, proportionately, if the water is bad. The leg of boiler should be provided with handhole plates or plugs, just above the mud ring at each corner. The front flue sheet should have wash-out plugs—one on each side of exhaust pipe near bottom, also two or more near central part of boiler—so distributed that best results may be obtained in reaching all flues with a stream of water; the firebox flue sheet to be left blank opposite each plug hole in front sheet. Three plug holes in boiler head, just above crown-sheet level, so distributed as to avoid crown bolts and braces, and reach all portions of crown sheet with a stream of water. Fig. 2 shows design of wash-out pipes and nozzles. Pipe D is used from front end, and should be long enough to meet firebox flue sheet, the connection to hose to be flexible, so that pipe can be revolved as it is moved in and out between the flues. With judiciously located wash-out holes, the desired water pressure and intelligent handling of the pipes or nozzles, all the mud lodging amongst flues should be reached and dislodged.

Pipe A is for crown-sheet washing. It is intended to reach full length of crown sheet; the connection to hose to be flexible, as described. The opening for nozzle at right angles to pipe is to provide for the sediment moved from the crown sheet being carried over the sides of firebox, instead of on top of flues. Pipes B and C are for washing over furnace door, around leg of boiler and brick arch tubes.

Mr. F. W. Johnstone, of the Mexican Central Ry., submits a form of wash-out plug, shown in Fig. 3, concerning which he says: "This plug remains perma-

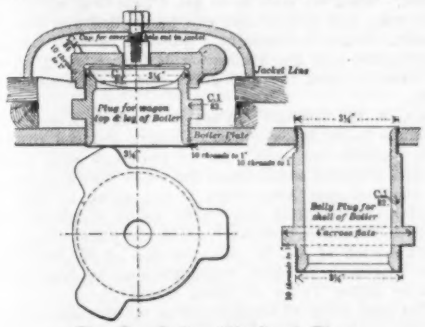


Fig. 3. Boiler Washout Plug.

nently in the boiler, so that there is no danger of the threads being crossed, as is the case with the ordinary tapering plug. With the old-style taper plug screwed into the sheet, the end of the plug often reaches into the water space, scale accumulates on the end of the plug, and when it is unscrewed it tears the thread out of the boiler sheet.

Mr. J. H. McConnell (Un. Pac.): On some districts we have a way of taking care of the boilers by putting in wash-out plugs just about the line of the crown sheets, between every other bar, and also on the back end of the butt sheet, and also over the furnace door. We have not had much difficulty with the door sheet cracking from the effects of the mud lodged just above the ring. We put a wash-out plug in there, and it has helped us a great deal. We have been helped in the same way with the crown sheets, and also in the cylinder part of the boiler. The greatest advantage we have is by the use of the heater; it has saved us much money and labor. We have found that by comparing engines that have the heater with those that have not, we have made a difference of about $16 a month in the price of coal consumed, in favor of the engines with the heater. The water goes into the boiler at 260°, and the solid matter that is held in suspension is deposited in the form of mud, and is readily blown out at the end of the division, or when we take water at the tanks. These heaters are running on the Seventh district of the Wyoming division. We have on that district several tanks that contain 82 grains of soda to the gallon, which makes a very light water—a hard water to use—as it foams badly, and, to a certain extent, is very destructive to the iron. We find our fuel will last considerably longer if we do not have to wash out our boilers so often. Where we had 35 engines one season, we are doing the same work now with 25, on account of the increased service, by not having to hold the engines to wash the boilers.

Mr. Geo. Gibbs (C., M. & St. P.): If we are to draw any conclusions from the experiments of the committee as to the cause of bulging of sheets, that conclusion would condemn this recommendation of a member to use the Perkins sheet, diaphragmed, between the side sheet and outside sheet: This would restrict the circulation more than it is restricted at present. The use of these lead plugs has shown, to my mind, that at times the water does leave the side sheet for an appreciable length of time, long enough for the sheet to get hot enough to melt lead, and probably red hot. If that is the case, it is due to an explosive action, and a contraction in the water space would increase the action. We have reason to believe that we can melt a metal plug at a lower temperature than that required for melting lead—630°—but we have not definitely determined it. The matter is interesting, and we shall follow it up. In the report Mr. McConnell speaks of using zinc plates. A short time ago we equipped a boiler with these plates, not for the purpose of stopping scaling, but to stop corrosion; and after the engine had been out a few weeks we found the zinc was in the bottom of the boiler, loose, and came out in the shape of powdered and spongy metal. It was puzzling to know how it occurred until we looked up the physical characteristics of the metal and found that at a temperature of 340° the metal becomes brittle and crumbly. We are obliged to give up the use of zinc for that reason.

Mr. J. H. McConnell (Un. Pac.): Our experience with zinc was that while we used the casting the same as is used in the telegraph batteries, we found that the casting was destroyed in about two trips over the road; it retained its form, but when you picked it up you could break it with your fingers, and only here and there find a crystal of the zinc; the action of the water had destroyed the zinc. We found in some instances it would soften the scale, and it would make the engines foam. We did not have any good results with it.

Mr. A. E. Manchester (C., M. & St. P.): I have been curious to know just why it was the Rushforth heater has done such good work. On the St. Paul system we have had a number of mechanical purifying devices, and, taking them as a whole, the results have been bad. About five years ago we had a mechanical purifier put onto ten new engines. One of these was sent into Missouri, and the best results were obtained by the use of the device in that state. The water we used was heavily laden with the substance of which the Missouri River is full in suspension. It would take this material out of the boiler by blowing out, and would enable us to run the boiler from two weeks to two months without washing out, and at the end of that time the water in the boiler was still practically clear, while engines running with the ordinary equipment had to be washed out as often as every 300 or 500 miles, and the water would be very dirty. But the same device applied in lime water districts—fairly good lime water districts, with 20 to 25 grains of incrusting material to the gallon—soon filled up and left our boilers in a worse condition than if there had not been any device applied. The action seemed to be that the blowing-off of the mechanical device—and the action of all we tried was the same—took out every particle of non-incrusting matter and left the hardest of the incrusting matter to adhere to the sheets. This was so hard that it never scaled off, as is usually the case with limes deposited on metals. My idea was that the purifiers took out all of the non-incrusting matter, and by so doing took out that portion which would naturally be floating in the water. This portion that was floating would adhere to the different portions of the metal by lodging against it; the lime would then form over these non-incrusting matters, leaving a line of weakness, and it would gradually fall off by vibration. This was not the case with the purifier. The lime deposited in them you could hardly chip off with a chisel. We tried the zinc plate in making our experiments. We did not know whether the point of the plug showed any indications of heat or not; it simply crumbed and went to pieces.

The pipe marked D in Fig. 2 is used from the front end. The nozzle is 14½ ft. 6 ins. long; in the use of it the pipe is supposed to be run in and out of the boiler the length of the flues. The pipe marked A, used on the crown sheet, is to be the length of the longest crown sheet. The opening for the nozzle is at right angles; the object of this is that the force of the water shall throw all the scale and sediment washed from the crown sheet over the side of the firebox, instead of on to the flues, where it would be hard to reach, and where it would have a tendency to fill up between the flues.

Mr. Wm. Forsyth (C., B. & Q.): The discussion shows that the principal causes of bulging are from scale, or mud, and bad water. I do not think the second cause given, "insufficient water space," is one that is necessary to refer to, in order to explain the bulging of side sheets. I have seen side sheets ten or twelve years old perfectly straight; and I think it is the case in New England, where good water is used, that there is very little trouble from bulging side sheets. The reason why I think there is very little difference between a narrow and a wide water space is that if there is a small accumulation of scale on the side sheet and an intense fire on the other side, the interference there prevents the transmission of heat through the sheet, and the water is driven away from the sheet, and it will be driven away and the sheet heated, no matter whether the space is 3 ins. or 1 ft. The bulk of water at the side makes no difference. I question whether the committee is justified in giving this as one of the principal causes, and whether any one has any evidence that narrow water space is the cause of the bulging of side sheets, or that a wide space will prevent it. I think it is due to scale and mud. I think also a thin, hard scale will produce this, because we know that a lamination in the sheet will cause an interference of the transmission of heat, and produce bulging, and this thin, hard scale is somewhat analogous to a lamination. I think we should try to find something that will remove that hard scale at the same time the tubes are removed.

The Rushforth feed-water heater is recommended; but we may regard that as a series of blow-off cocks. The amount of heating surface in that heater is not 1-10 the number of square feet there are in an ordinary stationary feed-water heater, and there is no chance whatever for it to operate as a genuine feed-water heater. In regard to the economy, I think we are apt to be deceived in that, too; because it is not due to the increase in the temperature of the feed-water, but it is due to the removing of scale.

Mr. D. L. Barnes: The mechanical feed-water heater is known to be a success; but a locomotive is about a 1,000-HP. machine, and a satisfactory mechanical feed-water heater, which will act as a purifier, made on the plan of the most practical heaters used in stationary boiler practice, would be larger than the locomotive boiler. It cannot be made to operate with satisfaction if it is much smaller. The action of the heater is understood. The water must first be heated to a temperature near the boiling point and then allowed to stand until the impurities fall out. In a boiler of the locomotive type, running on the road, they use a barrel of water a minute; and it would probably take 15 minutes for the impurities to settle. I think there is a misapprehension about the direction of the flow of water in locomotive boilers. We know that the water comes in at the injectors and falls to the bottom of the shell, and then proceeds to the bottom of the firebox leg and rises upward; and anything put in the way of the raising of the water would interfere with the circulation. It is practically impossible to get anything to descend in the water leg; all the water there is going up. The causes of the water leaving the sheet may be several. Those who have boiled water in glass vessels know, if the vessel is contracted and long, like a tube, if you get a bubble big enough it will force the water out of the head of the tube, and the smaller the tube the quicker this action will take place. By putting in this sheet you would induce that action. If the sheet is hot the water will form into steam so rapidly that very little of the sheet will be in contact with the water. The heat will be taken up slowly, but there comes a point when the heat will increase rapidly, and finally the last condition is, the sheet gets red hot and then the water will not touch the sheet. These considerations show us that this circulation sheet is a failure. The committee says, "There is every reason to believe the circulation would be improved by such a device in the water legs of a boiler." I do not think they have given any reason for such an expression of opinion. The secret of the success of the Rushforth water heater, as has been said here, is in the blow-off cocks. In modern practice the boiler is kept free from incrustations by blowing it off; and if it is blown off frequently, I think there will be no trouble. I ask Mr. Manchester if this zinc plug was melted with one overheat or more; it is not every time that the boiler is fired up that these sheets get overheated; but it is when the fire gets in unusually good condition near the sheet, and what is known as "blowpipe" action takes place. You can put a blowpipe against a sheet and drive the water from it and make it red hot. That will take place in a fire, with good soft coal, when the draft is concentrated in the proper way. It is not the object of this report, as I understand it, to show that sheets will bulge when the scale is on—we have known that for many years; but the question is, why do they bulge when there is no scale, which is the experience of a good many people. This question frequently comes up; and it may be due to the fact that we have got the fires in locomotive boilers (no increase in grate, but great increase in the amount of fire required) so hot that there will be times when the water will not stay against the sheet.

Mr. S. M. Vauclain (Baldwin Locomotive Works): Mr. Barnes' point in regard to the temperature of the fire is well taken. In locomotives where the fireboxes are much contracted, we have more trouble with side sheets overheating and bulging than in fireboxes where the grate surface is large. The grate surface should be increased to keep down the rate of combustion for bituminous coal at least to 125 to 140 lbs. per sq. ft. of grate surface per hour; in many cases it runs as high as 250 to 200 lbs. The contracted grate also reduces the percentage of direct heating sur-

faces in the boiler. We know that very wide fireboxes of the Wootten type are long-lived as compared with the narrow, contracted fireboxes burning bituminous coal. There is no other reason for it than the slower rate of combustion, and less intensified heat at that point. There is another reason why the narrow, contracted box would give more trouble; it is in the circulation of the water, which Mr. Barnes has described. So far as the influence of the feed-water heater is concerned, it seems to me that you might as well drop a little brown sugar in the water. To have the full benefit of it to remove incrusting matter, it would be necessary to have one built upon scientific principles. In some locomotives we have an evaporation of 65 gallons of water a minute, and in one hour's run nearly empties a 3,800-gallon tank; so that to provide a feed-water heater sufficiently large to take care of that you would be required to have a 60,000-lb. car, with the apparatus on, hauling it back of the locomotive.

Mr. R. H. Soule (Norf. & Wn.): I gather from the discussion and report that there are four principal causes which result in bulging fireboxes—concentrated action of the fire, insufficient width of the water space formation of scale on the sheets, accumulation of mud in the leg. I do not think we can improve the handling of our fires. Mr. Vauclain has thrown out the hint that the best escape from that trouble would be in the direction of enlarging our fireboxes. As regards the width of the water leg, we are tied up there also; we are in between the wheels in nine out of ten engines, and we cannot widen out that space without reducing our grate area, which would be an evil in the other direction. As regards the formation of scale on the inside of the sheets, due to certain ingredients in the water, it makes me tired to think of the experience we have been through in that matter, and all the experiments that have been made with different boiler compounds. I feel as if, from a railroad standpoint, life is too short to spend much time with these matters. That brings us down to the matter of mud, and to my mind our best chance for escape from these troubles lies right there. The practice that we have to-day in general use in the matter of boiler washing is the use of the little instruments you find in round-houses, known as boiler washers or squirts. In a few years from now we will feel that it is boy's play to perpetuate the use of such apparatus. What we need is to have in every round-house where engines are handled in considerable numbers powerful pumps, with a plentiful supply of steam, so that we can go at the business in a sensible way, washing boilers thoroughly and frequently throwing into them a large volume of water at high presure. This may be supplemented by the use of nozzles of various forms and shapes. I do not think there is any more practicable solution of the matter than to put in powerful pumps in each round-house.

The report of the committee on the best material for locomotive boiler tubes was next read.

Locomotive Boiler Tubes.

The committee recommended the following specifications for locomotive boiler tubes:

Material.—Tubes to be made of knobbled, hammered charcoal iron and lap welded.

Dimensions and Weights.—The dimensions and weights of 2-in. and 2¼-in. tubes shall be as follows:

Thickness B. W. G.	Weight 2-in. tubes, lbs. per ft.	Weight 2¼ in tubes, lbs. per ft.
No. 13	4.91	2.16
No. 12	2.17	2.46
No. 11	2.38	2.70
No. 10	2.64	2.99

Surface.—Tubes must have a smooth surface, free from all laminations, cracks, blisters, pits and imperfect welds. They must also be free from bends, kinks and buckles—signs of unequal construction in cooling or injury in manipulation—and must be of uniform thickness throughout, except at weld, where one gage number additional thickness will be allowed, perfectly round and cut to exact length ordered.

Physical Tests.—Strips ¼ in. wide by 6 ins. long, planed lengthwise from the tubes, after being heated to a cherry-red and dipped in water at 80° F., shall bend in opposite directions at each end without showing cracks and flaws, and when nicked and broken the breaks must show a fracture wholly fibrous. Sections of tubes 12 ins. long, 5 ins. of which shall be heated to a bright cherry-red in daylight, when placed in a vertical position, and a smooth, turned, tapered steel pin at a blue heat is driven in by "lap" blows with a 10-lb. sledge hammer, must stretch to 1¼ times their original diameter without split or crack. One tube is to be tested in each lot of 250 tubes or less. Tubes must expand, turn over tube plate and bend down, without flaw, crack or opening at weld.

Hydraulic Test.—Each tube must be subjected by the manufacturer to an internal pressure of 500 lbs. to the sq. in.

Etching Tests.—In case of doubt as to the quality of material, the following test shall be used, viz.:

A section of tube turned or ground to a perfectly true surface, polished with fine emery paper, and free from dirt and grease, to be suspended in a bath of water, 9 parts; sulphuric acid, 3 parts; muriatic acid, 1 part. The bath should be prepared by placing the water in a porcelain dish, adding the sulphuric acid and then the muriatic acid. Chemical action is allowed to continue until the soft parts are sufficiently dissolved so that an iron tube will show a more or less finely-ridged surface, with the weld very distinct; a steel tube will present a homogeneous surface with the weld quite indistinct, and sometimes almost imperceptible.

General Requirements.—Each tube must be plainly stenciled "Knobbled Hammered Charcoal Iron" and "Tested to 500 Pounds," and tubes must be so invoiced. Each tube must also be subjected to careful surface inspection, as provided for above; and those measuring 1-64 in. over or under the diameter ordered shall be rejected. Failure of a single tube to pass any of these tests shall be cause for the rejection of the entire order.

In presenting these specifications the committee stated that while various forms of combination steel and iron tubes had been offered for use in recent years, it was the universal opinion of the members of the Association that the best results were obtained by the use of a single material. This material should be the best obtainable. The committee considered this to be knobbled hammered charcoal iron. It was also stated that the question of a tensile test had been considered in connection with elongation, etc., but after careful consideration it was decided that such a test would be of little importance. In regard to the drift pin test, the committee stated that it had been demonstrated that no tube of common charcoal iron would stand the strain of this most crucial test.

The discussion on this report was opened by Mr. Geo. Gibbs (C., M. & St. P.).

Mr. Geo. Gibbs: I have made a close study of this specification for boiler tubes. We have had one in use for a good many years which does not differ materially in some of the items from the one proposed. I think, however, that it is a cheaper one to make for a railroad that has a testing machine. It distinguishes between the two grades of tubes—a body grade and safe end grade. I do not believe it is worth while to buy as expensive a tube as this would require for the body of the flue. I have, therefore, divided our specifications into two grades. The committee report that the hammering test of the tube section is objectionable, as not showing the quality of the inside layer of the tube. The hammering test spoken of is very objectionable; it does not show anything, and it is a much less severe tests than the crushing test. The crushing test, as made in a testing machine under the ordinary rates of speed of making a scientific test, is more severe than the hammer test. I believe it shows exactly the quality of the tube, if, in addition to the actual figures given by the test, you take into account the appearance of the flue and its general behavior. This physical test of cutting a strip out is expensive, and unless the strip is prepared carefully and of uniform width, I do not believe it will be of much value. The etching test we consider of great value. I have a number of good etchings of different kinds of tubes, both body grade and safe end grade, and of steel and iron. The steel tubes in both cases show indistinctly a scarfed end, the weld is entirely open, although it is sufficiently close, possibly, to be tight when the tube is set in. The etchings also show a flue, sold as an iron flue, which is iron inside and out, and has a steel center. It is an attempt to palm off on the railways a thing they do not want.

Mr. T. A. Lawes (C., C., C. & St. L.): The committee desired to voice the experience of the members of the Association, and for that purpose they issued a circular asking if it was practicable to use a fair grade body tube with a first-class quality of safe end. The replies were of such a nature that the committee did not advise the use of two grades of material for locomotive boiler tubes. In regard to the testing machines, there are so few roads that are equipped with laboratories with testing machines that the point made there would be out of the question for a general specification to be used by all the roads in the country. In regard to the width of the test piece being of small moment, the committee tested a number of tubes of different makers—first quality tubes, fair quality tubes and the poorest obtainable. The poorest would not stand the bending test, as outlined in our specification.

Mr. J. H. McConnell (Un. Pac.): The tubes in the ordinary 18-in. cylinder locomotive have an aggregate length of about 2,400 ft. In some portions of the country the flues remain in ten years; west of the Missouri River the flues do not remain in the boiler to exceed ten months. A good grade of charcoal iron tubes, costing 10 cts. a foot, would answer the purpose in these boilers. It is customary on some divisions in the western country for the flues to be removed once every six months. I know there are many cases where, when they are taken out in six months, they cannot be returned. I know of a case where flues have been in an engine but two months and removed, and 60 out of 200 had to be thrown away, on account of being pitted. Flues at 17 cts. would cost $408; at 10 cts., $240. The recommendation of the committee while it might do for the eastern portion of the country, will not do for the western, where the water is bad and the flues cannot long remain in the boiler. I think it is a question of judgment which should be left to the people who use the flues, as to what price they should pay according to the service.

Mr. Geo. Gibbs: I agree with Mr. McConnell about the quality of flues; I see no reason for using 17 or 18 ct. flues in the body. You can use 10 or 12-ct. flues in the body, and save all the way from $70 to $100 on an engine.

Mr. A. E. Manchester (C., M. & St. Paul): Has the committee received any knowledge or information that would indicate to them that the 17-ct. tubes last relatively much longer than the 9 or 10-ct. tubes?

Mr. T. A. Lawes: The committee has not said that this tube cost 17 cts., nor that it costs 10 cts. The committee was appointed to report on the best material; the prices quoted for these various tubes was not to be considered. The principal makers of the country produce them, and you can buy them from 10 to 22 cts.

Mr. J. H. McConnell: We have paid 10, 12½, 17 and 22 cts. for tubes; and from the tubes that cost 22 cts. we have not had any better service than from those costing 10 cts.

Mr. Geo. Gibbs: As far as the price goes, there is nothing in the specification; but I think the flue which will pass the specification will cost about 16 cts. a foot. I find a difference of 6 cts. between safe end and body grade flues.

Mr. E. M. Herr (Chic. & Northw.): It is strange that these tubes can be obtained on a specification for a high-grade tube for so low a price. I have bought tubes on specifications of similar nature, and our experience is they cost 17 and 18 cts.

Mr. T. A. Lawes: There are different methods of making charcoal iron. We say knobbled hammered charcoal iron. In making the trial I spoke of there may be a difference in the quantity between the two layers. In hammering, some persons squeeze the bloom, instead of hammering properly, and we do not exactly stipulate how it is to be made in this specification. We say what makes a good iron; we do not stipulate the composition of the material; we do not go into details. I do not understand where the members got the idea that it is a high-priced tube.

Mr. M. Roberts (St. L., I. M. & S.): If we adopt this report it still leaves the Master Mechanics to make requisition for such quality of tubes as they require. What we want is to get a tube that will stand the wear, and a tube that can be applied and worked easily. When it comes to a question of labor in the application, and not a question of the action of water on flues, I think the high-grade flue is an economical one.

Mr. S. M. Vauclain: What we want is a specification for boiler tubes of good quality, and competition will regulate the price. As we have had such happy results with the specification for boiler plates, it seems to me that this Association is not going to make a mistake by adopting this report as its standard; and if it does make a mistake it is on the right side.

On motion of Mr. Barnes, the title of the specification was made to read, "Specifications for Iron Locomotive Boiler Tubes of Extra Quality."

The next order of business taken up was the reading of the report on Standard Sizes for Pamphlets. The sizes recommended were those adopted by the Master Car Builders' Association some time ago (see Engineering News, June 29, 1893, and June 14, 1894). It was voted to adopt the sizes recommended as the standard of the Master Mechanics' Association.

Adjustable and Stationary Wedges for Driving Boxes.

The first question taken up at the noon-hour discussion was whether the adjustable wedge for driving boxes was a necessity. In opening the discussion Mr. A. E. Mitchell stated there were a number of locomotives on the New York, Lake Erie & Western R. R. which had stationary wedges, and he would call upon his Master Mechanic to give the results of that railway's experience.

Mr. H. A. Childs (N. Y., L. E. & W.): Last October we started in and fitted up one of our engines with stationary wedges, by taking the centers and planing them up and removing the pedestal brass, and fitting the box to the wedges—a snug fit—before applying to the journals. That engine has been in service since that time, and we have added stationary wedges to 24 others, making 25 in all. We are getting excellent service from them; never had a hot box on the engine, and experience no trouble. In the mogul engines we find little wear in the front driving wheels, and, of course, it is not necessary to line them up, but the main ones and back drivers we did. The engines have been in service nine months, and the first one has been lined twice since that time.

Mr. W. H. Lewis (D., L. & W.): My experience is similar to Mr. Mitchell's. We took up this question some two years ago, and since that time I have equipped a number of engines engaged in all kinds of service; both eight and ten-wheel engines. We have experienced no trouble. It is true we have an advantage over some types of engines, in having a thimble binder; in the event of a stuck wedge, we can loosen up the binder bolt and relieve it. In practice it has not been necesary to do so. We have run these engines some eight or nine months, but no relining was necessary. I think the trouble with the movable wedge is that engineers sometimes do not use the best judgment in adjusting them.

Mr. Wm. Forsyth: We had a great deal of trouble with loose wedges and loose wedge bolts. We have made experiments in this matter during the last three

years. Our Master Mechanic is so pleased with the fixed wedges that he has recommended them for the whole road. It has been adopted as a general practice on our road; and all our repair shop work is done with fixed wedges.

Mr. J. H. Setchell: Is there any money in it? One reason assigned by Mr. Lewis was that on account of the injudicious way in which wedges are sometimes set the crank pins and axles are put to undue strain and are broken. That seems to be a very good reason, but nothing has been mentioned outside of that as to the economy in construction and durability in keeping the engine up.

Mr. Wm. Forsyth: There would be a slight difference in first cost, in favor of the fixed wedge. It does away with the wedge bolts, and with the work in preparing the taper. It is evident that when our Master Mechanics are unanimously in favor of a radical change of that kind they must have some very good reasons for it.

Mr. W. H. Lewis: I think the members will admit that a very large percentage of round-house repairs is from broken wedge bolts, and the saving in that item alone would justify the adoption of the stationary wedge.

Compound Locomotives.

The second question for special discussion was whether the compound locomotive had gained any headway during the year.

Mr. Geo. Gibbs (C., M. & St. P.): I am convinced that the compound is the coming locomotive for freight service; it behooves us to help this advancement all we can. We will make some mistakes in the compounds. You may say it is an easy matter to stick on another cylinder, and therefore it should not be much of an experiment. It is a radical change, however; changes the steam distribution, valve motion, etc. The compound engine offers the most universal means of accomplishing a fuel economy of 15%. We have had one compound for four or five years; we ascertained the economy on an elaborate test of the engine, and it is still showing that economy. I find from a record of two years' performance there has been spent an average of about 2½ cts. per 100 miles for repairs, as against 4 7-10 cts. for the other engines of the same class; about $1,000 a year less. It is easy to make 10% difference in the coal economy, saving $500 a year in fuel.

Mr. A. E. Mitchell (N. Y., L. E. & Wn.): We have on the extreme westerly end of our road eight Baldwin compounds, 10-wheel, 62-in. wheel. They have been in service two years, on fast and slow trains—mostly fast freight trains—and giving excellent results. They save from 8% to 10% in coal, and about 15% in water. The water is more important, as the incrustation of the boiler with us is very great; with the simple type we only get eight or ten months' service out of the flues. With the compound, we get 12 to 14 months' service.

Mr. D. L. Barnes: We started out in this country with two cylinder compounds with numerous automatic devices. The result of experience has been to take those off, until the engines are almost universally made, here and in Europe, with an independent exhaust for the high-pressure cylinder. You absolutely cannot handle an engine properly without having an independent exhaust from the high-pressure cylinder. The experience of marine work has been brought into play, and we have copied to some extent the ports and valve motions used in marine work. The advocates of compound locomotives ought to be careful about the extravagant claims set forth as to their performances. They are extravagant, and if we are not careful, we will be led into serious errors. The limit of efficiency of a compound engine, if non-condensing, could not be much lower than 22 lbs. of water per HP.-hour. In a recent paper read before the American Society of Mechanical Engineers, 18½ lbs. was claimed. Another man claimed 17½, but he did not give all the facts. He measured his 17½ lbs. from the indicator card, while the engine probably showed 24 lbs. (quite another matter). Some discoveries relative to indicator cards, resulting from tests on compound engines, have been recently made. We find that with a long pipe connection from the cylinder to the indicator an engine can be made to show 1,000 HP. when it is actually developing only 800 HP. The compound locomotive started out in this country with one low-pressure piston, weighing 800 lbs. The builders have been forced to use a lighter piston. If there is any difficulty in the way of the further introduction of the compound locomotive, it is a matter of the weight of the reciprocating parts. Railway superintendents are becoming exercised by damages to track which cannot be accounted for by the loads on car wheels. It comes from the excess balance in locomotives, and for high speeds, unless the wheels are made very large, it may be we will have to stick to simple engines for that reason alone. In England the compound has been abandoned, while in Germany and other countries where the railways are under the control of the government, and haul their trains more economically, the compound is on the increase. One of the causes of reported failures of compounds is to be found in the fact that they are not always adapted for the work they are called upon to do.

Mr. S. M. Vauclain (Baldwin Locomotive Works): In regard to compound locomotives, I beg to say that we are still building quite a number of them, and meet with varied success. The building of compound locomotives is not attended with good luck at all times. You have a certain amount of grief mixed in with the joy that comes to you, and you have got to put up with it. It is the grief which prompts you to do good work. The use of compound locomotives has given to railway companies in the United States a means of reducing their operating expenses to a greater extent than any other item or improvement connected with the operation of locomotives. We have had several examples lately of how energetically the companies proceed in the methods of saving oil. If the railways would proceed as energetically in the direction of perfecting the compound in saving fuel, the amount saved would have a greater bearing upon the cost of operation. If we turn to Europe, where they have been using compound locomotives for a much longer period than we have, we find that, on the whole, compounds are making great headway. In Russia almost all the locomotives for freight service, and a large number of those for passenger service, are compound locomotives, built under various plans and designs. We have shipped four-cylinder compounds of our own type to Russia. We know of two-cylinder compounds that have been ordered, and a number of others that are in use. In Germany the two-cylinder compound has made much headway. In France, the four-cylinder is used almost exclusively, and has been referred to as a complicated engine. We must not lose sight of the fact that all French locomotives are complicated, and no doubt they fully realize all the saving it is possible to realize with compound locomotives. We have had compound locomotives running for over five years, and in following up some of the first compounds, we find that about the same economy is effected at the present time as was effected when the engines first went into service. The engines we are building to-day are superior to the engines built then. It is natural that they should be. We have been able to find out and locate the worst strains and provide against them. We often find on a railway to which we would send one compound that it would give no end of trouble. If a road has a number of compound locomotives, we find the repairs sometimes slightly in excess of single expansion, and sometimes slightly smaller. Up to the present time we have not been under the necessity of rebuilding a single compound locomotive as a simple engine; but we have furnished compound cylinders for a number of single-expansion locomotives. We have inquiries at present referring to a number of just such cases. We have come to the conclusion that on a number of the high-speed passenger trains in use in this country the engines are too heavy for the work, and it is simply a question of boiler capacity, and not adhesion. We recently took one of the velocipede, 6½-ft. driver engines, removed the side rods, balanced up the wheels accurately, and operated the locomotive for six months as a single-driver engine, similar to hundreds of such engines in use in England, and had very excellent results. All through the very coldest weather last winter, through the blizzard, this engine came in and went out as nicely as any other. The performance was so satisfactory that we are to-day building a compound single-driver locomotive with 7-ft. driving wheels, with the same heating surface, and 2 ins. more stroke to the compound cylinders. The reason of this is that we found for high-speed service the single-expansion engine is needed to a certain point. After that point is reached, you must get back to compound cylinders, in order to increase the efficiency of your boiler, and get the advantage of the 15 or 20% you are able to save in the consumption of water. When you operate a compound locomotive up to its maximum efficiency, evaporating 65 gallons of water a minute, if single-expansion cylinders were applied to the same engine it would be impossible to make the speed.

Mr. E. F. C. Davis: The compound locomotive is without question, in my mind, the locomotive of the future, but its progress would be much more rapid if the advocates of the compound were more moderate in their claims. The principle of using steam by double-expansion instead of in a simple cylinder is so well understood, and so well appreciated by engineers, that it seems hardly necessary to say anything further on this part of the subject. The object of every design of a compound locomotive should be to keep the mechanism in its simplest form and use as few working parts as possible, and have as much of the engine similar to the simple engine as can be. Some of the later types of two-cylinder compounds have been doing such uniformly good service that it looks really as if the compound engine of the future had arrived.

Wednesday's Session.

The first business of the session was the reading of the report on Pistons, Piston Rods and Fastenings.

Pistons, Piston Rods and Fastenings.

The pistons in current use may be roughly grouped under three heads: (1) The bull-ring piston, which has a T-ring, or bearing ring, to which is bolted a follower plate; (2) the box piston, either cast with internal cored recesses, or made in halves, which are subsequently fastened together, and (3) single-plate pistons, which have no internal cored recesses, but are solid metal throughout.

The advocates of the bull-ring piston claim that it is the only form of piston which, when repaired, can be made at small expense to fill its cylinder completely, and thus reduce lost motion and wear to a minimum. For the box piston it is claimed that it is simple, cheap and has no loose parts, and that it can be made of cast iron with sufficient strength for usual diameters. The single-plate piston is probably the form which best combines strength and lightness, which are acknowledged to be necessary features of pistons of large diameter, and particularly for pistons of high-speed locomotives, since the weight of the piston is a minimum. No fixed rule seems to be observed in determining the relation between the width or thickness of the piston and its diameter, but in a general way it may be said that the best accepted practice in the matter of 20-in. pistons is to make them from 5½ to 6 ins. wide on the face. Some of the requirements in a locomotive piston are: Strength, lightness, low first cost, cheapness of maintenance and renewal, minimum exposed surface, fewest parts possible that can work loose and knock out cylinder heads, and a good system of packing rings.

In designing piston rods, it is desirable to reduce the size and weight as much as possible, and to provide a good fastening to the piston. The usual and preferred method of fastening the piston rod into the piston is by a nut. A few, however, dispense with nuts, the end of the taper fit of the piston rod being riveted into a countersunk recess in the face of the piston. Another practice is to force the piston onto the piston rod by hydraulic pressure.

In the use of packing rings the practice most prevalent is to use cast iron rings, which are turned to a diameter larger than that of the cylinder in which they are to be used, and which subsequently have a piece cut out of them in order that they may be reduced to the desired diameter. The committee states its conclusions as follows:

The conclusions of the committee are briefly that for pistons of moderate diameter and for use in slow-speed engines there is an open choice between the bull-ring form and box form, while for pistons of any diameter, if for high-speed engines, the single plate type presents the important advantages of lightness combined with strength. In piston rod fastenings the taper fit with nut at the piston end and key at the crosshead end seems to be the arrangement which is justified by the best practice. The tapers which are in current use vary between the extremes of ⅞ in. in diameter in 12-in. length to 1½ ins. in diameter to 12-in. length, while a fair mean representing average practice may be considered to be 1 in. in diameter in 12-in. length.

Mr. Gordon: I notice in the report it is stated that where the body of the piston is made of steel or wrought iron it is customary to tin the outer edge where it bears against the cylinder walls. I would like to hear what has been the experience in regard to the wearing of the tin; whether it gave good service.

Mr. E. F. C. Davis: The Richmond Locomotive Works did this in compound engine pistons 29 × 32 ins. in diameter. We wanted to make the piston of something better than cast iron, and we used the best 80,000-lb. steel. We cut a dovetail groove in the middle of the piston face, and filled that with tin or babbit. That worked very successfully, and did not cut the cylinder at all. The tin, however, would break up by the change of temperature, and we then cast the ring of bronze in sections, and cast it about one-sixth of the section at a time, turning the ends of each section to its preceding section, so that when the ring was cast the shrinkage would not break it apart. After the ring was cast the piston was put back in the lathe, and the bronze ring turned up so as to project 1-32 in. beyond the face of the steel piston. This proved to be very effective, and prevented any trouble whatever from the steel pistons.

Mr. A. E. Manchester (C., M. & St. P.): I would like to know what the form of the boss is on either of the cylinder heads; if they are straight, what do they do with the area or space that is formed in the Z of the piston head, the clearance space at the end of the cylinders?

Mr. E. F. C. Davis: In the case of the compound engine, with the low-pressure cylinder, the heads are made to conform very closely to the shape of the piston. As the piston is turned up to a template, it is very easy to turn the heads to fit the piston very closely. This refers to the low-pressure cylinder, where the clearance should be as small as possible. When we first began building two-cylinder compound

locomotive we did not realize how much clearance we would require in the high-pressure cylinder, and made the piston heads and cylinder heads flat in the ordinary way. We very soon found out, however, in running the engine at very high speeds that it would be necessary to either cut out the exhaust openings of the valve to a very objectionable degree to avoid excessive compression, or else give more clearance in the cylinder. We therefore introduced the Z-form of piston in the high-pressure cylinder and left the heads flat, which has given the requisite amount of clearance space at the ends of the cylinders, and gives a very light and strong form of piston head.

Mr. E. M. Herr (Chic. & Northw.): The recommendations seem to lean strongly to the single-plate piston. We have had some experience with that type, made similar to the form spoken of by Mr. Davis. It is the first form, babbit rings cast into it, and our experience has been unfavorable. They run very nicely for a time, but after a while the babbit rings broke up and we had serious trouble with them. I question very much if the bronze ring will be a permanent improvement. After the 1-32-in. clearance which it has is worn off, I am doubtful whether the steel will not produce bad effects in coming in contact with the cast iron on the cylinder walls. I believe we have not reached anything near the limit of lightness of design for a bull ring type of piston. That type possesses many advantages not possessed by any other. There is but a small and inexpensive part of the piston to renew when it is worn smaller, and one which can be replaced in a short time. This cannot be done with the plate pistons, even if the brass rings prove satisfactory. I think there is considerable room for lightening the design of the bull-ring piston and making it of the strongest material obtainable. We have a great deal of trouble in the breaking of piston rods on all classes of engines. A year ago, while in Germany, I took occasion to investigate this matter as thoroughly as I was able to do in the shops visited. I could not find that they had any trouble with broken piston rods. Instead of making the rod as we do, with the tapering end that fits into the crosshead the smallest part, they make it the largest part. To do this with our practice would entail two split stuffing boxes and split packing rings. They use almost exclusively the hemp packing. This form of rod will lessen the breakages of the piston rods. They fit the key carefully without sharp corners, and use very large fillets between the end of the rod and the body, which is considerably smaller than the end of the rod. Our practice of going to large piston rods as breakages occur is objectionable, not only from the standpoint of increasing the dead weight of the reciprocating parts, but also from the fact that it takes just that much more area from the back side of the piston. It makes the engine not only less powerful, but less steady in its movements.

Mr. T. W. Gentry (R. & D.): I lately examined a cylinder in which the piston had been provided with a brass packing ring and had made considerable mileage. The cylinder had become perfectly glazed, and while the brass ring had worn down visibly (the cast iron was almost in contact), yet there did not seem to be any tendency for the steel head to scrape up against the cast iron. I accounted for this from the fact that we introduced into a newly-bored cylinder a newly-turned steel piston, the two rough surfaces immediately engaged each other and this action commenced. If we can introduce something in the cylinder that will prevent the scratching or cutting until we get the cylinder thoroughly glazed, we know this is less apt to occur; and it is possible that the manner of introducing the brass ring is the nearest thing we can get. We have not had any success with block tin or the hardest kind of babbit metal. If we can keep the brass ring there long enough to glaze the surfaces so that with proper lubrication they will not engage each other after that, we will probably have something of value. As to the method of fastening the piston-head to the rod, we tried the brass nut, and we found it quite difficult to keep the brass nut tight. Just why they will not stay tight after being properly fitted, I do not know. I think it is generally admitted they will not stay tight. We have reduced the number of threads to the inch on the end of the rod, making them five; and, in addition to that, we warm the cast iron head or steel head, as the case may be, and shrink it on; we do not heat it very hot, but just enough to be able to shove it on with an hydraulic press. We get a tighter job than putting it on cold.

Mr. E. F. C. Davis: I will give a little experience with the cast steel piston in connection with the cast iron cylinder. On the first compound we built at Richmond for the Chesapeake & Ohio Railroad we put a steel piston in the low-pressure cylinder, with babbit metal in the groove, and an ordinary cast iron box piston with bull ring was used in the 19-in. high-pressure cylinder. This engine has been in service about three years, and we have had a good opportunity to watch the wear of both pistons. Recently when the engine was in the shop for some general repairs it was found necessary to rebore the high-pressure cylinder on account of wear from the cast iron piston with bull ring, but the low-pressure cylinder, with the steel piston, was in such fine condition that it was impossible to discover any appreciable wear whatever, and the surfaces were all very nicely polished.

Mr. Geo. Gibbs (C., M. & St. P.): The question of broken piston rods is not a question of quality of material only. We have tried all qualities of iron, from the best English to the ordinary American, and we have had a great deal of trouble with them all; the best is not much better than the poorest. There must be something wrong with the general practice in this country in making a taper-fit piston rod with an approximately square shoulder. We must strive to improve the design.

Mr. John MacKenzie (N. Y., C. & St. L.): It would be interesting to know what kind of cross-heads they are using. The experience we have had with 26 engines fitted with the common four-bar guide, with 3-in. piston rod, 19-in. cylinder, has been that we broke them as fast as we could get them.

Mr. J. H. McConnell (Un. Pac.): The Laird cross-head and steel piston rod is the worst thing you can put on a locomotive; more piston rods are broken from that source than any other. We rarely have a piston rod broken from the four-bar guide. We went through the experience for a number of years in using steel piston rods, and when we adopted iron, the best we could get, the breakage to a large extent ceased, except in the Laird cross-head. I do not believe you can use any kind of piston rod in the Laird cross-head that will not break.

Mr. J. O. Patte (Great North'n): We have something like 225 engines, ranging from 19×24-in. to 20×26-in. cylinders, working under 180 lbs. pressure. All of the cross-heads are of the Laird type, and not a single rod has broken. I think this is perhaps partially due to the fact that we turn down the end of the rod very little, thinking it is cheaper to replace a rod than to replace piston, cylinder head and rod. The cross-head is 19½ to 21½ ins. long.

Mr. R. Wells (Rogers Locomotive Works): It seems to me the breakage of piston rods is mostly due to the cross-head being out of balance, you may say. I have taken a cross-head of the ordinary size, and have found that its center of gravity was 4¾ ins. above the center line of the piston rod, and it weighed probably 325 lbs. In looking into the breakages reported, we found that they occurred mostly on engines with that kind of cross-head, where the speed of the engine was excessive. They had wheels not more than 4½ ft. in diameter, and ran at speeds of 50 miles an hour. The effect of that center of gravity being so far above the center line of the piston would necessarily cause the rod to break in course of time. I know the Laird cross-head has been used for a number of years with good success, but it was where the engines were run at moderate speed, probably not more than 20 to 25 miles per hour. The breakages referred to mainly occurred with that kind of cross-heads in engines running at unusually high speed for the size of drivers. The cross-heads used with four-bar guides are often made with the wings so high above the circle that their center of gravity is probably 3 ins. above the center of the piston line, and where breakages occur I think it is due largely to cross-heads of that kind. The center of gravity of the cross-head is too far above the center line of the piston rod. The tendency at the end of each stroke is for the cross-end to continue on, and at the other end the action is reversed. As to the two-bar guide, one above and one below, I have not known of any trouble there from broken piston rods, because the cross-heads of that kind are balanced.

Mr. Wm. Forsyth (C., B. & Q.): This report is a good introduction to the subject, and it should be continued, and the next report accompanied with detail drawings of large pistons, the details of the piston rings and the fitting of the piston rods to the piston, and also the piston rod to the cross-heads. I do not agree with much that has been said in regard to the breakage of rods due to the shape of the pistons. Mr. Herr refers to the practice in Germany. That will not be of much benefit to us, because their experience has been largely with low speeds. They do not run much over 40 miles an hour. They are about in the condition as to speed that we were 20 years ago. I do not think the enlargement of the piston fit in the cross-head is necessary, for the reason that in recent years, to my knowledge, we have not broken any piston rods in the smallest section through the key-way. We have been troubled with breakage of piston rods of large diameter, both with the Laird cross-head and with the wide spread guides, which is a balanced cross-head. I think the reason is largely, if not solely, due to the shoulder on the piston rod. With piston rods with shoulders we have obtained only about 75,000 or 80,000 miles before they begin to crack and are taken out; while with piston rods with this shoulder entirely removed and the plain piston rod turned down with the taper, we have obtained double that mileage. They are still in service, and we do not expect them to break. I do not think it is a matter of quality of material, because we have obtained the best quality of iron and steel, and have had them break in about the same time. They should be fitted without the shoulder. In regard to the plate and box-shaped piston, I think there is more hope for the plate design, especially in large diameters. I do not think Mr. Herr would advocate the use of bull rings and double packing in 29, 30 and 32-in. piston heads. In designing a 24-in. piston for our compound engine we obtained the drawing from Sir William Armstrong's works at Elswick, England. They are similar to those used in the United States, I think.

Mr. E. M. Herr (Chic. & Northw.): As to the bull ring piston, I did not contemplate advocating that piston for a low-pressure cylinder in a two-cylinder compound. I do not think it is practicable to use it there, but spoke of it for small engines, in which we are using a large number of steel plate pistons now. I found in Prussia they had trains carded to run at 40 miles an hour, and these engines every day made speeds of over 60 miles. It was to the pistons of those engines that I referred. The piston end of the rod was not larger than the stuffing box. They tapered the other end of the rod, and I suppose put the rod in through the stuffing-box, and fastened the piston on afterwards.

This closed the discussion on this subject, and the report on riveted joints for locomotive boilers was read. This report was quite long, and was largely a compilation from well-known authorities on such work. As most of the matter is familiar to our readers, we do not give the report. The discussion was short, and consisted mostly of criticism of one or another of the formulas. This discussion was followed by the reading of the report on the Wear of Driving Wheel Tires. The report was unusually complete, but owing to it not being printed we defer its publication to a future issue. The next report taken up was that on the Transmission of Power. The committee stated that it had not been able to make a report, and on vote of the Association it was discharged.

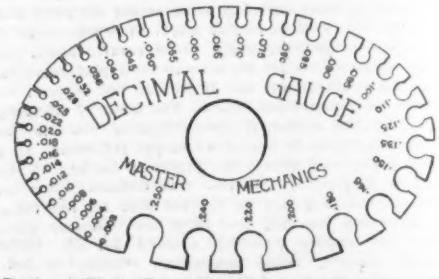
During the convention the Committee on Gages submitted its report, as abstracted below:

Gages for Sheet Metal, Tubes and Wire.

The report called attention to the great variety of gages now in use, and stated that the committee had conferred with the similar committee of the American Society of Mechanical Engineers, and with manufacturers, and had sent out a circular of inquiry to the members of the Master Mechanics' Association. Unfortunately the answers to this circular of inquiry had not been as numerous as the importance of the subject warranted, but they showed that a great majority of the members were heartily in favor of adopting a decimal gage. The same was true of manufacturers.

As a result of these inquiries, the committee of the Master Mechanics' Association and of the American Society of Mechanical Engineers met and passed the following resolution:

Resolved, That while the micrometer gage should be used for test purposes in the laboratory, yet for general shop use a solid notched gage is desirable. The form of the gage should be an ellipse whose major axis is 4 ins., the minor axis 2½ ins. and the thickness 0.1



Decimal Plate Gage for Shop Use Recommended by Committee Master Mechanics' Association.

in. There should be either one hole 0.75 in. in diameter in center, or one at each of the foci for lightening and convenience. This gage should be plainly stamped with the words "Decimal Gage" in letters 0.2 in high, and below this the name of the trade which the group of notches is to cover, these groups to be selected with reference to the needs of the several trades.

All sizes of notches to be marked in thousandths of an inch without a zero prefixing the decimal point, but with inch marks after the figures, thus: .002".

It is also the intention of this committee that in ordering material the term "gage" shall not be used, but merely the thickness in thousandths of an inch.

The convention elected the following officers: President, R. C. Blackall; First Vice-President, R. H. Soule; Second Vice-President, Pulaski Leeds; Secretary, Angus Sinclair; Treasurer, O. Stewart.

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PERSONALS.

Mr. W. L. Franklin has been appointed City Engineer of Johnstown, Pa.

Mr. Frank T. Oakley has been appointed Assistant City Engineer of Toledo, O.

Mr. T. D. Wilson has been appointed Naval Constructor at the Boston Navy Yard.

Mr. Almon Parker has been elected Superintendent of Public Works at Watertown, N. Y.

Mr. William Moore, of Edora, Ia., one of the proprietors of the Edora Sewer Pipe Co., died June 19.

Mr. E. G. Russell, has resigned his position as Superintendent of the Rome, Watertown & Ogdensburg R. R.

Mr. Gustave R. Tuska, Jun. Am. Soc. C. E., Consulting and Constructing Engineer, has opened an office at 62 William St., New York city.

Mr. W. W. Jeffers, of Ticonderoga, N. Y., has been appointed Assistant Engineer on the Middle Division of the Erie Canal.

Mr. H. H. Houston, who has been a director of the Pennsylvania R. R. since 1881, died at Philadelphia, Pa., June 21, at the age of 75.

Mr. T. R. McCloud has been appointed Chief Engineer of Tests of the Carnegie Steel Co., at Homestead, Pa., succeeding Millard Hunsiker.

Mr. W. E. Williams, of the firm of Leete & Williams, engineers and architects, of Huntington, W. Va., has been appointed City Engineer of Huntington.

Prof. Wm. C. Williamson, F. R. S., LL. D., the well-known geologist and biologist, died at Clapham, London, England, on June 23, at the age of 79.

Mr. Charles Simpson, mining engineer, was shot and killed by a Mexican near Jimenez, Mexico, while on his way to inspect mines on the Sierra Madre mountains.

Mr. Martin Corcoran, of Pittsburg, Pa., contractor for stone and masonry, died recently, at the age of 50. He was formerly a member of the contracting firm of Corcoran & Killen.

Dr. Daniel C. Gilman, President of Johns Hopkins University, Baltimore, Md., has accepted the position of Chief of the Department of Awards for the Cotton States & International Exposition at Atlanta, Ga.

Messrs. H. H. Sprague and Wilmot R. Evans, of Boston, Mass., and Mr. Whipple, of Brockton, Mass., have been appointed by the governor as members of the Metropolitan Water Supply Commission of Boston.

Mr. A. R. Sweet has been engaged by the Sewer Commission of Woonsocket, R. I., as Superintendent of Sewer Construction, for one year. He was recently engineer for the Bridge Commission of that city.

Mr. Amos L. Hopkins, who was Vice-President and General Manager of the Wabash R. R. in 1876, and has since been connected with other roads of the Gould system, has been elected President of the New York, Susquehanna & Western R. R.

Major G. W. Raymond, U. S. Engineer Corps, in charge of the Philadelphia district, has been appointed upon the Board of Engineers and the Board of Harbor Lines of New York, both of which boards have offices in New York city.

Mr. R. C. Steifl has been appointed Superintendent of the Elwood Weldless Tube Works, Elwood City, Pa., vice Mr. J. C. Roberts, who has resigned to take a similar position with the New Castle Weldless Tube Co., of New Castle, Pa.

Prof. R. C. Carpenter, of Cornell University, has been promoted to the chair of experimental engineering, and Assoc. Prof. Chas. L. Crandall has been made Professor of Civil Engineering, in charge of railway engineering and geodesy. Assoc. Prof. Wm. F. Durand has been made Professor of Marine Engineering, and Principal of the Graduate School of Marine Engineering and Naval Architecture, and Assoc. Prof. H. J. Ryan has been made Professor of Electrical Engineering.

Herr Baensch, the Engineer of the North Sea and Baltic Canal, was born in 1825, and in 1846 left the Berlin Academy of Construction and entered the public service as an inspector of land and water-works. He later entered the field of iron construction, and built many railway bridges, stations and workshops. He was sent to examine into the devastation of the North coast of Prussia by the sea, and his report and recommendations attracted much attention, and he was made director of harbor and canal works, and had in charge the improvement of the Rhine. When the ship canal was decided upon he was selected as the engineer best qualified to direct the operations upon it.

Mr. James Renwick, the well-known architect and one-time civil engineer, died in New York on June 23. Mr. Renwick was born at Bloomingdale, on Nov. 1, 1818; graduated at Columbia College in 1836, and immediately began the study of architecture and engineering. He began professional work as an engineer on the western division of the Erie Railway; but within a year he became an assistant engineer on the Croton Aqueduct, and for four years was engaged in superintending the construction of the reservoir at 42d St and Fifth Avenue, New York city. In 1845 he designed and built Grace Church, all except the spire, and later he built Calvary Church and the Church of the Puritans. Mr. Renwick planned the new buildings of the Smithsonian Institute and the Corcoran Art Gallery, in Washington. His greatest work was St. Patrick's Cathedral, in New York, commenced in 1858 and dedicated in 1879. Mr. Renwick was one of the oldest members of the American Institute of Architects, and was one of its past Presidents.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

INDIANAPOLIS ENGINEERING CLUB.
July 9. Secy., C. C. Brown, City Engineer.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
June 25 to 28. Annual Convention at Detroit, Mich., F. R. Hutton, Secy., 12 W. 31st St., New York city.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
June 25 to 28. At Niagara Falls, N. Y. Secy., H. W. Pope, 26 Cortlandt St., N. Y.

INTERNATIONAL RAILWAY CONGRESS.
June 26 to July 10. At London, England. Secy., F. Weissenbruch, Brussels, Belgium. Secy. of English Branch, W. M. Acworth, London, England.

ENGINEERING ASSOCIATION OF THE SOUTH.
June 27. Secy., H. D. Ruhm, Nashville, Tenn.

COLUMBIAN ENGINEERING SOCIETY.
July 2. Secy., W. F. Hart, University Building, 15th and H Sts. N. W., Washington, D. C.

WESTERN SOCIETY OF ENGINEERS.
July 3. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
July 9. Secy., F. A. Coburn, Case Library Building.

MONTANA SOCIETY OF CIVIL ENGINEERS.
July 13. Secy., Forrest J. Smith, Denver Block, Helena, Mont.

ENGINEERS' CLUB OF MINNEAPOLIS.
July 15. Secy., E. Nexson, Kasota Block.

AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.

ENGINEERS' CLUB OF PHILADELPHIA. At the meeting on June 15, Mr. William D. Beatty read a paper describing the coal storage plants of the Philadelphia & Reading R. R. There are two general methods employed, the "hillside" plan, generally used in the mining regions, and the "level-floor" system, located at or near shipping points. At Port Richmond a plant on the Dodge system is now being constructed, which will occupy about 15 acres, and consist of six piles of coal, two of 20,000 tons each, two of 30,000 tons each, and two of 40,000 tons each. In this system the coal is stored by a chain-conveyor, with a trimming machine attached, and the coal is reloaded by a pivoted ground conveyor with lifting troughs for screening and storing in cars. It is expected that nearly $40,000 per annum will be saved by the use of the Dodge system, which was fully described.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—At the meeting on June 20 Prof. Leon Le Pontois read a paper on "The Inefficiency of the Direct Methods of Converting Heat into Electrical Energy." It was decided to give up the present quarters in Allegheny and move back to Pittsburg.

WESTERN PENNSYLVANIA CENTRAL MINING INSTITUTE.—The semi-annual meeting was held at Pittsburg last week, with about 130 persons present. Papers were read on "The Double-Entry System of Working Mines," by J. Hanford, and on "Fans and Fan Tests," by J. J. Evans, the latter recommending a small number of large fans rather than a large number of small fans. The subjects discussed included legislation relating to mining, the qualifications of mine foremen, and the comparative merits of the tail-rope and endless-rope systems of haulage.

WASHBURN ENGINEERING SOCIETY.—This society, of Worcester, Mass., recently made a trip to Chaffin's to inspect the new water power plant, driven by 18-in. horizontal Hercules turbines. Tests made showed about 18 HP. developed by each wheel.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on June 19, Mr. H. A. Wheeler gave an address on "Vitrified Brick for Street Paving." This material has been used in Holland for over a century, and in the north of England for a slightly shorter period. In Charleston, W. Va., it had been in use for 25 years, and in Bloomington, Ill., for 20 years, and it is now used in about 400 cities and towns in this country. This year marks its adoption in the cities of St. Louis, Chicago and New York. Mr. Wheeler explained the process of manufacture, and material used, and exhibited numerous samples. It is now quite possible to secure a paving brick of high grade, provided engineers will insist upon quality, and pay a price which will warrant greater care in every detail of manufacture, and more time in cooling. Laboratory tests are frequently misleading. Satisfactory inspection can be made at the yard by an experienced man simply by the eye and the hammer. Tests made in the laboratory cover the crushing, cross-breaking, absorption, and the tumbling of brick in a foundry rattler.

William H. Bryan, Secy.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
June 28.	Building, Faribault, Minn.		June 6
June 28.	Hire of dredge, New Orleans, La.		June 6
June 28.	Pumping machinery, San Francisco, Cal.		June 13
June 28.	Pumping engines, Asbury Park, N. J.		June 20
	Advertised, Eng. News, June 20 and 27.		
June 28.	Boilers and stack, Asbury Park, N. J.		June 20
	Advertised, Eng. News, June 20 and 27.		
June 28.	Brick paving, St. Louis, Mo.		June 20
June 28.	Stand-pipe, Maywood, Ill.		June 20
	Advertised, Eng. News, June 20 and 27.		
June 28.	Dredging at Brooklyn navy yard.		June 20
June 28.	Garbage crematory, Fort Wayne, Ind.		June 27
June 28.	Steel rails (400 tons), N.Y. & Bk.yn Bridge		June 27
June 28.	Iron bridges (5), Paterson, N. J.		June 27
June 29.	Wooden bridge, Cape Girardeau, Mo.		June 6
June 29.	Pipe sewers (5,430 ft.), Ithaca, N. Y.		June 20
June 29.	Railway (20 miles), Hamilton, Ont.		June 20
	Advertised, Eng. News, June 20.		
June 29.	Iron work, etc., Washington, D. C.		June 20
June 29.	Water meters, Toronto, Ont.		June 20
June 29.	Breakwater, Block Island, R. I.		June 27
	Advertised, Eng. News, June 27.		
June 29.	Electric ry. equipm't, Bowling Green, Ky.		June 27
June 29.	Iron bridge, Dundee, Mich.		June 27
June 29.	Sewer, Racine, Wis.		June 27
June 30.	Jail, Wilkes Barre, Pa.		June 13
July 1.	Water-works system, Deckertown, N. J.		May 30
	Advertised, Eng. News, May 30 to June 13.		
July 1.	Water-works system, Cullman, Ala.		May 30
July 1.	Crib dike, Wilmington, Del.		June 6
July 1.	Water supply, Jersey City, N. J.		June 6
July 1.	Road construction, Bristol, Me.		June 6
July 1.	Sewers, (9½ miles), Grinnell, Ia.		June 13
	Advertised, Eng. News, June 13 to 27.		
July 1.	Water-wks. system, Elkhorn, Wis.		June 20
	Advertised, Eng. News, June 20.		
July 1.	Water bonds ($25,000), Montgomery, N.Y.		June 20
July 1.	Sewers, Winnetka, Ill.		June 20
	Advertised, Eng. News, June 20.		
July 1.	Resurfacing rds (7½ miles), Paterson, N.J.		June 20
July 1.	Stone sidewalks, Irvington, N. J.		June 20
July 1.	Bridge, Albany, N. Y.		June 20
July 1.	Lead pipe, Syracuse, N. Y.		June 20
	Advertised, Eng. News, June 20.		
July 1.	Brick church, Columbus, O.		June 20
July 1.	Grading, Darby, Pa.		June 20
July 1.	Sewers, Darby, Pa.		June 20
July 1.	Court house, Winfield, W. Va.		June 20
July 1.	Bridge, Bronson, Fla.		June 20
July 1.	Sewers (1,800 ft), Dolgeville, N. Y.		June 20
	Advertised, Eng. News, June 20.		
July 1.	Heating and power plant, Waupaca, Wis.		June 20
July 1.	Water-works system, Memphis, Mo.		June 20
	Advertised, Eng. News, June 20.		
July 1.	Stone bridge, Syracuse, N. Y.		June 27
July 1.	Pipe sewer, Syracuse, N. Y.		June 27
July 1.	Crossings (14 sts.), Syracuse, N. Y.		June 27
July 1.	Water bonds ($200,000), Auburn, Me.		June 27
July 1.	Pumping eng. foundations, Albany, N. Y.		June 27
July 1.	Hydrants and pipe, New York, N. Y.		June 27
July 1.	Bridge, Ellendale, N. Dak.		June 27
July 1.	Chapel, Rochester, N. Y.		June 27
July 1.	Paving (7,300 sq. yds.), Dubuque, Ia.		June 27
July 1.	Street improvements, Chicago, Ill.		June 27
July 1.	Paving, Baltimore, Md.		June 27
July 1.	Brick paving, Washington, Pa.		June 27
July 1.	Pipe sewers, Bradford, Pa.		June 27
July 1.	School buildings (3), New Orleans, La.		June 27
July 1.	Laying water pipe, Albany, N. Y.		June 27
July 1.	Exposition building, Atlanta, Ga.		June 27
July 1.	Granite block paving, Albany, N. Y.		June 27
July 1.	Grading, etc., New York, N. Y.		June 27
July 1.	Paving brick, Wilmington, Del.		June 27
July 2.	Brick paving, Van Wert, O.		May 30
July 2.	Water-works franchise, Greenville, Miss.		May 30
July 2.	Garbage removal, Harrison, N. J.		June 13
July 2.	Water bonds ($7,000), Port Clinton, O.		June 13
July 2.	Dredging, Raleigh, Ont.		June 13
July 2.	Water-works system, Afton, N. Y.		June 20
July 2.	Street improvements, Trenton, N. J.		June 20
July 2.	Asphalt paving, Buffalo, N. Y.		June 20
July 2.	Underground conduits, Cincinnati, O.		June 27
July 2.	Water-works system, Fort Sheridan, Ill.		June 27
July 2.	Gas piping, Leamington, Ont.		June 27
July 2.	Naval supplies, Washington, D. C.		June 27
July 2.	Repairing school buildings, Brooklyn		June 27
July 2.	Street and sewer bonds, Allegheny, Pa.		June 27
July 2.	Curbing, etc., Trenton, N. J.		June 27
July 2.	Pipe sewers, Dayton, O.		June 27
July 2.	Sewers, Cincinnati, O.		June 27
July 2.	School building repairs, Toronto, Ont.		June 27

July 2. College building addition, Toronto, Ont. June 27
July 2. Pipe sewers (3 miles), Winchester, Mass. June 27
Advertised, Eng. News, June 27.
July 2. Brick sewers, Troy, N. Y. June 27
July 2. Air chambers, etc., Philadelphia, Pa. June 27
July 2. Asphalt paving, Indianapolis, Ind. June 27
July 2. Brick and cement sidewalks, Indianapolis. June 27
July 3. Bridges, Ukiah, Cal. Apr. 18
July 3. Electric railway sale, Beatrice, Neb. June 13
July 3. Paving materials, Montreal, Que. June 20
July 3. School buildings (2), Madison, Ga. June 20
July 3. Laying water pipe, Yonkers, N. Y. June 20
July 3. Levee work, Port Allen, La. June 27
July 3. Highway bridges (4), Lyons, Kan. June 27
July 3. Stone flagging, Cleveland, O. June 27
July 3. Roof at aquarium, New York, N. Y. June 27
July 3. Arsenal repairs, New York, N. Y. June 27
July 3. Flagging, etc., New York, N. Y. June 27
July 4. Highway bridge, Hempstead, Tex. June 13
July 5. Stone culverts, Columbus, O. June 13
July 5. Sewers, Mattoon, Ill. June 13
July 5. Brick paving, Mattoon, Ill. June 13
July 5. Water-works system, Cornwall-on-Hudson. June 13
Advertised, Eng. News, June 13 to July 4.
July 5. Water bonds ($19,000), Princeton, Minn. June 27
July 5. Park supplies, Baltimore, Md. June 27
July 5. Brick paving, Mattoon, Ill. June 27
July 5. Street improvement, Avondale, O. June 27
July 5. Brick paving, Wilkes Barre, Pa. June 27
July 6. Water-works system, Rockville Center, N. Y. June 20
Advertised, Eng. News, June 20.
July 6. Driving piles, Sioux City, Ia. June 20
July 6. Overflow sewer, Boston, Mass. June 20
July 6. Jail cells, Auburn, Cal. May 16
July 6. Brick arch, Mansfield, O. June 20
July 6. Brick paving, etc., Lansing, Mich. June 27
Advertised, Eng. News, June 27 and July 4.
July 6. Grading, Alexandria, Va. June 27
July 6. Brick church, Morgantown, W. Va. June 27
July 6. Pipe sewers, Indianapolis, Ind. June 27
July 6. Iron bridge superstructure, Mitchell, Ont. June 27
July 6. Grading, etc., Indianapolis, Ind. June 27
July 8. Courthouse, Baltimore, Md. May 9
Advertised, Eng. News, May 9 to 23.
July 8. Buildings, Lafayette, Ind. June 13
July 8. Macadamizing, Stapleton, N. Y. June 20
Advertised, Eng. News, June 20 to July 4.
July 8. School building, Cheney, Wash. June 20
July 8. Smoke preventing device, Cleveland, O. June 20
July 8. Plate girders, Syracuse, N. Y. June 20
Advertised, Eng. News, June 20.
July 8. Sewers, East Orange, N. J. June 20
Advertised, Eng. News, June 20 to July 4.
July 8. Water-works, Monmouth, Ill. June 27
Advertised, Eng. News, June 27.
July 8. Highway bridges (3), Anthony, Kan. June 27
July 8. Brick buildings (6), Medfield, Mass. June 27
July 8. Armory repairs, Albany, N. Y. June 27
July 8. Cell house, Trenton, N. J. June 27
July 8. Grading, etc., Cincinnati, O. June 27
July 8. House connections, Palmfield, N. J. June 27
Advertised, Eng. News, June 27.
July 8. Pipe sewers, Bloomfield, N. J. June 27
Advertised, Eng. News, June 27 and July 4.
July 8. Street lighting, White Plains, N. Y. June 27
July 8. Sewers, New York, N. Y. June 27
July 8. Fire hose, Baltimore, Md. June 27
July 8. Improvement bonds, Philadelphia, Pa. June 27
July 9. Steel water tank, Cincinnati, O. June 13
Advertised, Eng. News, June 20 and 27.
July 9. Water-works system, Red Hook, N. Y. June 20
Advertised, Eng. News, June 27.
July 9. Brick sewers, Buffalo, N. Y. June 27
July 9. Sewers, Brooklyn, N. Y. June 27
July 10. Reservoir, New York, N. Y. June 20
Advertised, Eng. News, June 20 to July 4.
July 10. Water-works system, Amboy, Minn. June 27
July 10. Wharf repairs at Port Royal, N. C. June 27
July 10. Plans for school buildings (4), Detroit. June 27
July 10. Pipe sewers (1¾ miles), Pittsfield, Mass. June 27
Advertised, Eng. News, June 27.
July 10. Sewer materials, Pittsfield, Mass. June 27
Advertised, Eng. News, June 27.
July 10. Flagging (29 contracts), Brooklyn, N. Y. June 27
July 10. Paving, etc. (8,350 sq. yds.), Butler, Pa. June 27
July 11. Electric light plant, Knoxville, Tenn. June 20
Advertised, Eng. News, June 20 to July 4.
July 11. Street lighting, Knoxville, Tenn. June 20
Advertised, Eng. News, June 20 to July 4.
July 11. Iron bridge, New Orleans, La. June 20
July 11. Water-works, Wenona, Ill. June 27
July 11. Water tank at Fort Meyer, Va. June 27
July 12. School building repairs, Chicago, Ill. June 27
July 12. Paving, Buffalo, N. Y. June 27
July 15. Brick pvg (13,165 sq.yds.), Waukegan, Ill. June 20
Advertised, Eng. News June 20 and 27.
July 15. Electric lighting, Vicksburg, Miss. June 20
July 15. Sewers, Swarthmore, Pa. June 27
July 15. Court house vaults, Helena, Mont. June 27
July 16. Court house, etc., Houston, Tex. June 27
July 16. Macadamizing, Morristown, N. J. June 27
Advertised, Eng. News, June 27 to July 11.
July 17. Dredging and removing ledge, Newport. June 20
July 19. Water and light bonds Windom, Minn. June 27
July 25. Electric light plant, Bellefontaine, O. June 20
July 20. Water-works franchise, Perth, Ont. June 20
July 20. School buildings (2), Cleveland, O. June 27
July 20. Water-works system, Union, Mo. June 27
Aug. 2. Electric lighting, El Paso, Tex. May 23
Aug. 5. Plans for state capitol, St. Paul, Minn. Apr. 25
Aug. 6. Court house, Dublin, Ga. June 20
Aug. 12. Building addition, Los Angeles, Cal. June 27
Aug. 20. Capitol building, Olympia, Wash. June 20
Oct. 1. Plans for art building, Philadelphia, Pa. May 23
Advertised, Eng. News, May 23 to June 27.

RAILWAYS.

East of Chicago.

BOSTON & MAINE.—The directors have voted to extend the double track on the Gloucester branch from Manchester to Magnolia, two miles, and to reconstruct the passenger and freight stations at Manchester, Mass. President Tuttle is quoted as stating that $600,000 will be spent this year upon equipment.

COLLINS & WHEELER.—The Clarion, Pa., "Democrat" states that this railway, in Forest county, Pa., is to be extended up Coon Creek and Beach Bottom, and will probably become a part of the Beach Bottom R. R.

JAMES BAY.—The railway committee at Ottawa has granted a charter to the James Bay Ry. Co. to construct a line from Parry Sound, Ont., or from a point on the line of the Canadian Pacific between Sudbury Junction and North Bay to James Bay, at a point where Moose River enters the bay. The capital stock is $1,000,000.

PHILADELPHIA & READING.—The Philadelphia "Times" states that the contract for the building of an extension to the South Chester R. R. has been awarded to John G. Mill, of Philadelphia.

PITTSBURG, AKRON & WESTERN.—Press reports state that this company will probably spend $500,000 this summer for equipment.

ST. STEPHEN & MILLTOWN.—D. T. Maxwell, Engr., St. Stephen, N. B., writes us that the following contractors submitted bids for the construction of this railway: Joseph McVay, W. H. Maxwell, Thompson & Budd and D. F. Maxwell, of St. Stephen, N. B., and H. M. Balkam, of Milltown, N. B. The contract has not yet been awarded. The road runs from St. Stephen to Milltown, N. B., 4½ miles. No additional work is projected. Pres., John D. Chipman, St. Stephen.

TORONTO, HAMILTON & BUFFALO.—The contract for the Hunter St. tunnel at Hamilton, Ont., has been awarded to Andrew Onderdonk, of Chicago, and the work is to be commenced at once and completed in six months.

WASHINGTON COUNTY.—It is stated at Machias, Me., that the directors of this company have voted to open subscription books for stock, and ask the county for aid at a date not later than July 20. They expect to raise $200,000 by subscription, and hope to have the road under contract this year. The officers elected in 1894 were as follows: Pres., Geo. A. Curran, Calais, Me.; Treas., N. B. Nutt, Eastport, Me.; Clk., Geo. A. Murchie, Calais, Me.

Southern.

BALTIMORE & LEHIGH.—Press reports from Baltimore, Md., state that this company contemplates the substitution of electricity for steam on its entire line. The road extends from Baltimore to Delta, Pa., 43 miles. Ch. Engr., W. A. Moore, Baltimore.

CHARLOTTE HARBOR.—The citizens of Charlotte Harbor, Fla., are reported as trying to secure the construction of a railway from that place to connect with the Florida Southern between Liverpool and Steel Creek, a distance of about six miles.

GREENVILLE, NASHVILLE & CHATTANOOGA.—The contract for completing the grading and laying track on the Corinth & Tennessee River division of this road, from Corinth to Hamburg, Tenn., 18½ miles, was awarded June 21 to Arnold, De Garis & Co., Memphis. Gen. Man., Geo. H. Bunch, Memphis, Tenn.

GUYANDOT COAL LAND ASSOCIATION.—This company will build about two miles of railway to coal mines above Dingess, W. Va., to connect with the Norfolk & Western R. R.; will let grading to contract, and wants to buy, either new or second-hand, 56-lb. rails. Communications should be addressed to J. C. Miller, Supt., Dunlow, W. Va.

MONTGOMERY, TUSCALOOSA & ST. LOUIS.—Press reports from Birmingham, Ala., state that Capt. J. W. Woolfolk, Gen. Man. Tuscaloosa Belt R. R., Montgomery, Ala., is in that city preparing to begin work on the completion of this road as soon as the mortgage is foreclosed and the bondholders buy it in and get a clear title, which will be done in a few weeks. Capt. Woolfolk has just placed surveyors in the field between Tuscaloosa, Ala., and Columbus, Miss., as the road will be extended to the latter place as soon as the construction work already done between Montgomery and Tuscaloosa is finished. He says the entire line, 200 miles in length, will be completed in one year. It will complete the link which, with the Mobile & Ohio and the Plant system, will form a new through line from St. Louis to Savannah and Florida. The Mobile & Ohio is reported as behind the scheme.

OHIO & KENTUCKY.—The Winchester, Ky., "Democrat" states that engineers have begun the preliminary survey for this railway at Jackson. The proposed line will begin at Elkatawa, a station on the Lexington & Eastern, three miles west of Jackson. It will cross the Kentucky River at the mouth of Frozen Creek and follow that stream to its head, giving Breathitt county 12 miles of the road. It will bring a railroad within 15 miles of Salyersville, 10 miles of West Liberty and 6 miles of Hazel Green, and will open some of the finest coal and timber lands in the state.

TALLAHASSEE EASTERN.—This company has been organized at Tallahassee, Fla., to build a railway from that city, via Gainesville, to some point on Charlotte Harbor; Pres., Edward Lewis; Vice-Pres., J. M. Mays; Secy. and Treas., Wm. C. Lewis.

TITUSVILLE, CANAVERAL & PENINSULAR.—Howell Titus, Pres., Titusville, Fla., is quoted as stating that contracts will soon be awarded for building this railway from Titusville to Cape Canaveral, Fla., a distance of about 60 miles. The construction will be easy.

WEST VIRGINIA & PITTSBURG.—J. N. Camden, Pres., Parkersburg, W. Va., is reported to have announced the completion of plans for the construction of a new railway line from Clarksburg, W. Va., to the Ohio River at New Martinsville, 150 miles, and tapping the richest coal territory of Northern West Virginia. Work is to begin at once.

Northwest.

CHICAGO, PEORIA & ST. LOUIS.—C. H. Bosworth, Receiver and Gen. Man., Springfield, Ill., has been authorized to spend $20,000 for a terminal into the city of Springfield, Ill., and for ballasting and improving the road.

CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA.—The officials of the Superior Short Line, the Duluth and Superior terminal of this road, have filed $1,500,000 of first mortgage bonds with the Union Trust Co., of New York, for the purpose of pushing the construction of the road, which will be about 10 miles in length, with about 30 miles of side tracks. Large docks will be built on Allouez Bay and other improvements made. Secy., E. F. Woodman, Hudson, Wis.; Gen. Man., E. W. Winter, St. Paul.

DAVENPORT, CLINTON & EASTERN.—The contract for building this railway between Davenport and Clinton, Ia., 34½ miles, is reported to have been awarded to McArthur Bros. & Co., of Chicago, the other bidders being T. A. Kearns & Co., of Chicago; Halvarson, Richards & Co., of Minneapolis; Parker & Jackson, Hastings, Minn.; L. J. Smith, Kansas City; Tabeck & Preston, Des Moines; Breen & Freely, Alexandria, Va.; Barron & Peace, Marseilles, Ill.; Ryan Bros. & Co., St. Paul; J. J. McCaughey, Summit, Cook county, Ill.; Flick & Johnson Construction Co., Davenport, Ia.; Edwards & Walsh Construction Co., Davenport, Ia.; J. A. Ware, St. Louis; Mallory, Cushing & Co., and Creech & Murphy, Chicago.

DULUTH, MISSABE & NORTHERN.—The Hibbing, Minn., "News" states that as soon as the work of grading the spur to the Lake Superior mine is completed, it is probable the work of grading the new line of this road entering the village of Hibbing on the south side of the townsite will follow. As soon as this is done and the location of a depot established the Wright & Davis road will arrange for terminal facilities on the same grounds, and will at once proceed to extend their road into Hibbing.

OSHKOSH & BERLIN.—It is reported that John Martin and Chas. Martin, of Oshkosh, Wis., have been awarded a contract for building a railway between Oshkosh and Berlin, Wis., projected by Milwaukee capitalists. The right of way has been obtained and surveys completed, according to the reports.

Southwest.

KANSAS CITY, PITTSBURG & GULF.—Monroe & Lee, who were recently awarded a contract for a 10-mile extension of this road, as noted in our issue of June 6, are reported to have awarded the following subcontracts: J. A. Ware, of St. Louis, 5 miles; Bethuen Construction Co., of Nebraska, 9 miles; M. McTigh & Co., of Memphis, 14 miles, and G. A. Ware & Son, of Sedalia, 9 miles. Frank W. McCabe, of West Plains, Mo., secured the contract for the bridgework for this distance.

KANSAS CITY, WATKINS & GULF.—P. H. Philbrick, Cy. Engr., Lake Charles, La., is making surveys for an extension of this railway from Alexandria, La., to Natchez, Miss.

LINK LINE.—A proposition of New York capitalists to furnish money to complete this road between Georgetown and Granger, Tex., has been accepted by the directors.

ST. LOUIS, SILOAM SPRINGS & SOUTHERN.—Incorporated in Arkansas June 14 to build a railway from Fort Smith through the counties of Sebastian, Crawford, Franklin, Madison, Newton, Boone, Marion and Baxter, about 145 miles, to such a point on the northern line of the state as may be necessary to there connect with a railway now being constructed from St. Louis, thereby forming one continuous line from Fort Smith to St. Louis; capital stock, $5,000,000; principal office at Fort Smith, Ark. The names of the five commissioners to open the subscription books to the stock are as follows: W. M. Fishback, Frank Park, John Mathews, Geo. Sengie, David J. Young. The stockholders are: Hector D. Mackey, of St. Louis, 26,000 shares; Wm. J. Kreybill, of Pomona, Mo., 20; Jacob E. Kreybill, of Pomona, Mo., 20; Frank Park, of Fort Smith, 10; John Mathews, of Fort Smith, 10; George Senge, of Fort Smith, 10; David J. Young, of Fort Smith, 10.

WOODWARD & FORT SUPPLY.—At a meeting of the incorporators of this railway company at Woodward, Okla., June 4, the following officers were elected: Pres., A. G. Cunningham; Vice-Pres., John M. Pugh; Secy., W. T. Judkins; Treas., E. S. Wiggins; directors, A. G. Cunningham, P. M. Pugh, E. S. Wiggins, W. T. Judkins, Thos. Doran, J. McGrath and Peter J. Carroll.

Rocky Mountain and Pacific.

COLORADO & UTAH CENTRAL.—The Ridgway, Colo., "Populist" states that this company has been incorporated with a capital stock of $100,000, by S. S. Chauncey, J. McLean, Paul Cook and others.

CORRAL HOLLOW.—The Stockton, Cal., commercial association has appointed a committee to secure the right of way from the San Joaquin River into the city and two blocks of property on the water front for this railway, which is projected from the Corral Hollow coal mines.

EUREKA.—Frank N. Page, of Eureka, Cal., is reported as stating that this city has raised a subsidy of $60,000, which will secure the construction of a railway from that place to Grant's Pass, 50 miles.

SANTA FE SOUTHERN.—The Albuquerque, N. Mex., "Citizen" states that indications are favorable for the extension of this railway to that city at an early date.

SPOKANE TERMINAL.—Incorporated in Washington to build a terminal railway at Spokane; capital stock, $1,000,000; directors, S. Oppenheimer, W. R. Newport, E. J. Dyer and other members of the Northwestern Milling & Power Co.

STOCKTON & LODI.—The construction of a railway between Stockton and Lodi, Cal., recently noted, has been commenced. It will be a dummy line.

STREET AND ELECTRIC RAILWAYS.

BROCKTON, MASS.—The Brockton & North Easton St. Ry. Co. has been organized. Clk. and Treas., W. F. Pope, of Boston.

MILFORD, MASS.—It is reported that the money for constructing an electric railway from South Framingham, by way of Holliston to Milford has been subscribed. The road will be 12 miles in length, and is estimated to cost $120,000. Franchises will be asked for extending the road to Hopedale, Mendon and Uxbridge. It is reported that work on the road will begin at once and be completed by July 1, 1896. Chas. W. Shippee, of Milford, is interested.

MILLBURY, MASS.—The qustion is again being considered of incorporating an electric railway company to build a road in the Blackstone Valley, from this place to Northbridge. E. W. Shedd, of Worcester, is interested.

NEWTON, MASS.—The Commonwealth Ave. St. Ry. Co. has been incorporated to build a railway from Riverside of this city to the Boston line; capital stock, $45,000; incorporators, H. B. Day, of West Newton; A. D. S. Bell, of Cambridge; Chas. I. Travelli, of Pittsburg, Pa.; Geo. H. Ellis, of Newton.

NORTH ADAMS, MASS.—It is reported that bids are being received for building the Hoosac Valley St. Ry. from this city to Williamstown. Bonds for $75,000 will be issued at once. Pres., C. Q. Richmond.

READING, MASS.—The Reading & Lowell St. Ry Co. has been organized to build an electric railway from the Wakefield & Stoneham St. Ry. in Reading to Wilmington and Billerica Centre, a distance of 10 miles; capital stock, $50,000; James A. Bancroft and Chas. F. Brown, of Reading; Chas. F. Woodward and Henry H. Savage, of Wakefield.

PORTLAND, CONN.—The Portland St. Ry. Co. has been organized to build an electric railway. Pres., Oliver Gildersleeve; Vice-Pres., E. I. Bell; Secy. and Treas., Henry Kilby.

ROCKVILLE, CONN.—The Rockville, Stafford & Southbridge Electric R. R. Co. has been organized to build a road 12 miles in length. Surveys are now being made and work will probably begin soon. Pres., Wm. B. Ferguson, of Malden; Treas., Chas. C. Davidson, of Lewiston, Me.; Secy., R. S. Hicks, of Stafford Springs.

BUFFALO, N. Y.—The Buffalo, Gardenville & Ebenezer Ry. Co. has been organized to build an electric railway four miles in length, surveys for which are now being made, and it is stated that the work of construction will begin in a few days. Pres., Chas. L. Schoepflin, of Buffalo; Vice-Pres., Dr. E. H. Ballou, of Gardenville, N. Y.

CORTLAND, N. Y.—The Cortland & Homer Traction Co. has been granted a franchise to extend its electric road. Pres., F. W. Higgins.

SARATOGA SPRINGS, N. Y.—A company will probably soon be organized to build an electric railway between Greenwich and Schuylerville. Reeves Smith, of Troy, is making the surveys and work is expected to begin as soon as the surveys are completed. T. W. Cantwell and W. J. Wilson, of Albany, are interested.

UTICA, N. Y.—The Utica & Herkimer St. Ry. Co. has been incorporated to build an electric railway three miles in length; capital stock, $30,000; directors, David S. Foster, Geo. E. Dennison, W. J. Kernan, H. P. Crouse, of Utica.

WATKINS, N. Y.—The trustees have granted a franchise to the Watkins & Havana St. Ry. Co.

NEWARK, N. J.—The Consolidated Traction Co. has been granted permission to extend its electric road on Bloomfield Ave. from the city line to Liberty St., Bloomfield.

ALLENTOWN, PA.—It is reported that bids will be received at once for constructing an electric railway. V. D. Barner, A. D. Dresher and Dr. T. T. Martin are interested.

BEAVER FALLS, PA.—Press reports state that a company is being organized to build an incline railway to Patterson Heights, a suburb of this city. H. M. Myers, John Reeves and John T. Reeves and others are the principal movers in the enterprise. It will be 1,500 ft. in length and will have but one car, the balance to be maintained by weights, and it will be run by electricity furnished by the Beaver Valley Traction Co.

HARRISBURG, PA.—The Harrisburg Traction Co. has been incorporated to build an electric railway; capital stock, $1,500, with all paid in; director, W. J Calder, of Harrisburg.

McKEESPORT, PA.—The McKeesport & Port Vue Passenger Ry. Co. has been incorporated with a capital stock of $18,000; Pres., Gilbert F. Meyer; Secy., R T. Carothers, of McKeesport.——Fred Gwinner, of Allegheny, has been awarded the contract for building the Carnegie, Castle, Shannon & McKeesport Electric Ry.

MONONGAHELA, PA.—It is reported that Wm. F. Lloyd and J. W. Lloyd are to build an electric railway from Courtney to Black Diamond.

PHILADELPHIA, PA.—The Electric Traction Co. has voted to increase its capital stock $1,100,000 in order to make a number of extensions to its road, the most important one of which will be to Fox Chase. The proposed extensions will be about 20¾ miles in length. Ch. Engr., E. B. Ives.

PITTSBURG, PA.—The Pittsburg, Arlington Heights & St. Clair St. Ry. Co. has been incorporated to build a road to St. Clair by way of Mount Oliver; capital stock, $21,000; Pres., C. E. Owens, of Pittsburg; directors, Patrick Ridge and Michael Ridge, of Pittsburg. ——The Central Traction Co. has been granted permission to extend its electric road to the East End. Ch. Engr., L. Kirker.

WILMINGTON, DEL.—Arrangements are being made for the early construction of the Wilmington & Chester Electric Ry. Co.'s road. James C. McComb, of Claymont, is interested.

BALTIMORE, MD.—An electric railway company has been organized with a capital stock of $75,000 to build an electric railway to connect Mount Winans, Westport, Lansdowne and Meesters' Park, work on which, it is stated, will begin as soon as the company has been incorporated. Geo. A. Meeter, Dr. Wm. H. Crim, S. J. Carr and Wm. F. Porter are interested.—— It is reported that the Baltimore Traction Co. will soon award contracts for constructing a double track on the Pikesville railway.

BOWLING GREEN, KY.—Bids are asked until June 29 for constructing two miles of electric railway, a brick power house, 40 × 65 × 16 ft., and a brick car house, 25 × 80 ft., and for furnishing four miles of wire for overhead construction, 5 motor cars and one freight motor, two 125-HP. boilers, two 125-HP. engines, two 100-Kw. generators, etc., and 5,000 white oak cross ties, etc. C. H. Williams, Moorehead House, is the contractor. M. H. Crump, Secy., Park City Ry. Co.

CHAGRIN FALLS, O.—The Cuyahoga Suburban Ry. Co. has secured the right of way from Randall to this place. Work will begin as soon as the franchise has been granted. The company is about to increase its capital stock from $50,000 to $150,000. E. M. Yeomans, of New York, who is interested in the road, is considering the question of extending the railway to Meadville, Pa.

CUMMINSVILLE, O.—An electric railway company is about to be organized by citizens of Green and Colerain townships, Hamilton county, to build a road to Mount Airy, a distance of five miles. The capital stock will be $100,000.

TOLEDO, O.—The Toledo & Bay Shore R. R. Co. has been organized to build a road to Wigton's Point; capital stock, $25,000; incorporators, W. L. Hoyt, A. J. Snell, E. H. Potter and R. O. Thompson.

ZANESVILLE, O.—B. F. Fowler, Ch. Engr. Columbus & Zanesville Electric Ry. Co., is making surveys for the road from Zanesville to Columbus.

FORT WAYNE, IND.—It is proposed to construct an electric railway between this city and New Haven, Ind. Dr. L. S. Null is interested.

INDIANAPOLIS, IND.—N. J. Clodfelter, Pres., writes us that the Indianapolis, Anderson & Marion Ry. Co. has awarded the contract for constructing its electric railway to connect this city with Anderson, Alexandria, Jonesboro, Gas City and Marion, a distance of 35 miles, to the New York Standard Construction Co. Work will begin at once with 250 laborers. A tracklaying machine will be used, and the road will be completed by Aug. 1. Ch. Engr., A. B. Wilgus, of Indianapolis. (A. B. Wilgus and the New York Standard Construction Co. receive mail, but have no office, at 77 Nassau St., New York. Quite a number of electric railway contracts have been awarded to Mr. Wilgus within the last year, but none of the roads, so far as we know, have yet been built. —Ed.)

KALAMAZOO, MICH.—H. C. Reed, C. N. Chase, M. Henry Lane and Frank B. Lay have petitioned for a franchise for an electric railway on a number of streets.

MOUNT CLEMENS, MICH.—It is stated that the Mt. Clemens St. R. R. Co. and the Lake Side St. R. R. Co. have consolidated and reorganized under the name Mt. Clemens & Lake Side Traction Co. The new concern will equip all its lines with electricity as rapidly as possible.

CHICAGO, ILL.—The Badts Multiphase Electric Ry. Co. has been incorporated with a capital stock of $1,000,000; incorporators, Wm. A. Aylsworth, James C. Essick and Adolph Gray.

MILWAUKEE, WIS.—It is reported that Patrick Cudahy is interested in a projected electric railway from this city to the village of Cudahy.

PITTSBURG, KAN.—The Pittsburg, Frontenac & Suburban Electric Ry. Co. is about to extend its road to Chicopee. Secy., S. Barratt.

SPRINGFIELD, MO.—The Springfield Traction Co. has been incorporated to build a street railway; capital stock, $400,000, all paid in; incorporators, S. W. Fordyce, G. W. Parkes and Moses Rumsey, of St. Louis; C. B. McAfee, J. F. G. Bentley and A. J. Eisenmeyer, of Springfield.

MONTREAL, QUE.—Money is being subscribed for an electric railway from St. Remi to Napierville. The government has voted a subsidy of $3,200 per mile, and will do the same if the road be extended to Stottsville. James Fowler, U. S. Consul at Carleton Place, and Thomas Henry, Canadian agent of the Northern Pacific Ry. Co., are interested.

NIAGARA FALLS, ONT.—Press reports state that W. M. Kyle, of Toronto, has secured the right of way for a belt line electric railway on the Canadian side of the Niagara River, extending from the lower suspension bridge to Lundy's Lane battle ground, overlooking both falls and the upper and lower river. It will skirt along the high bluff down Clifton House hill, to the upper suspension bridge. Both bridges will be rebuilt this fall, and Mr. Kyle wants to cross them, make direct connections with American lines, and extend the road to Buffalo, besides up and down the falls on the American side.

ELECTRIC LIGHT AND POWER.

HYDE PARK, VT.—Press reports state that the trustees of the village have secured power for a municipal electric light plant, about 2½ miles from the village, on the Gihon River, which has its source in Big Pond, in the town of Eden. There will be a fall of about 30 ft. The dam will rest on solid rock on either side.

GREEN ISLAND, N. Y.—The trustees are negotiating the sale of $20,000 of 3½% bonds for constructing an electric light plant.

WHITE PLAINS, N. Y.—Bids are asked until July 8 for furnishing 50 arc lights of 1,200-c. p., and either 175 gas or 175 incandescent lights, for three years; all-night lighting. Wm. B. Sutherland, Village Clk.

SCOTLAND NECK, N. C.—A company is being formed for the purpose of establishing an electric light plant at this place. E. E. Hilliard, editor of the "Democrat," is interested.

HAWKINSVILLE, GA.—Samuel Way, Mayor, and Col. Chas. R. Warren are making arrangements for building an electric light plant.

BELLEVILLE, MICH.—Press reports state that Chicago and St. Louis capitalists are represented at Rawsonville, a place four miles from this city, by a civil engineer who has taken the level of the Huron River from Ypsilanti to Rawsonville, which shows that there is a fall of 36 ft. between these two places. Options have been secured on the Rawsonville woolen mills, also the flouring mills, for the purpose of placing a large dam in the river to obtain power for the generating of electricity. The proposed scheme is said to be a certainty and that active operations will be commenced in the near future.

CHARLEVOIX, MICH.—Charles Gabriel, of Saginaw, has been awarded a 10-year franchise for an electric light plant, work on which will begin at once.

STERLING, ILL.—The Standard Electric Co., of Chicago, has been awarded the contract, at $6,618, for an electric light plant of 600 incandescent and 30 arc light capacity, with a 90-HP. engine.

JANESVILLE, WIS.—The Bower City Light & Power Co. is about to erect a new power house at this place, according to reports.

LAOROSSE, WIS.—The engineer estimates the cost of constructing an electric light plant at about $25,000.

ARMSTRONG, IA.—It is stated that an electric light plant will probably be put in by a private company.

DOON, IA.—It is reported that an electric light plant will probably be erected within a year.

PRINCETON, MINN.—J. W. Hartman, Recdr., writes us that it is proposed to put in an electric light plant. Engr., C. F. Loweth, of St. Paul.

WINDSOR, MINN.—C. F. Loweth, of St. Paul, has been engaged to prepare plans for an electric light plant and water-works at this place.

NEW CASTLE, COLO.—It is reported that the American Electric Works Co., of Denver, is about to erect an electric light plant at this place.

NEW COMPANIES.—Amplified Electric Co., East St. Louis, Ill.; $1,000,000; Frederick Ulrich, Edwin J. Paule, John T. Dodwell.

Consumers' Light & Power Co., Spokane, Wash.; $250,000; S. Oppenheimer, W. R. Newport, E. J. Dyer, A. D. Hopper.

Cascade Electric Light & Power Co., Cascade, Ia.; $7,000; Pres., D. M. Finley; Vice-Pres., L. P. Freeman; Secy., H. L. Dehner; Treas., James W. Beaty.

Wolverine Electric Co., Detroit, Mich.; $10,000, with $3,000 paid in; Charles F. Scott, Piqua, O.; Ida A. Marks, Henry A. Marks, George A. Brooks, Piqua, O.

Washington & Tylerdale Electric Light & Power Co., Washington, Pa.; $1,000; Treas., J. F. Black, Washington, Pa.; Arthur Kennedy, Thos. B. Hutchinson, Francis J. Torrence.

BRIDGES.

LEWISTON, ME.—The Berlin Iron Bridge Co. has presented plans for a new bridge over the Little Androscoggin River. The present bridge is 18 years old and cost $1,800.

MONTPELIER, VT.—The citizens have petitioned the council of this city and the selectmen of Berlin to build a bridge over the Winooski River near Charles St.

GREENFIELD, MASS.—The contract for a new bridge across Green River has been awarded to the Groton Bridge & Mfg. Co., at $8,200. It is stated that the bridge will be 152 ft. long and have a 25-ft. roadway and two 4-ft. walks.

HUNTINGTON, MASS.—At a recent town meeting it is stated that 14 plans were submitted for a proposed new bridge, the estimated cost ranging from $8,700 to $10,500.

BRIDGEPORT, CONN.—John Walsh, Charles H. Hartman and others, residents of East Bridgeport, have petitioned the council to build a bridge across the Yellow Mill Pond from Hallam St. to Deacon St., and there is a probability of its being built this year.

BUFFALO, N. Y.—The board of public works received the following bids June 21 for the construction of the superstructure for a lift bridge on Michigan St. over the Buffalo River: Milwaukee Bridge & Iron Works, $59,080; Wisconsin Bridge & Iron Co., Milwaukee, $38,700; Rochester Bridge & Iron Works, $45,800; King Bridge Co., Cleveland, $51,500; the Buffalo Engineering Co., $28,375.

CENTERPORT, N. Y.—The residents of this place, on Long Island, are endeavoring to secure a bridge across Centerport Harbor. The bridge would be 600 or 700 ft. long.

SYRACUSE, N. Y.—Bids are asked until July 1 for constructing a stone arch culvert and a stone arch bridge over the Harbor Brook at West Genesee St. and at Park Ave., respectively. H. F. Stephens, Cy. Clk.

BELVIDERE, N. J.—The freeholders of this county are reported to have decided to build a new bridge at Hainesburg 78 ft. long, with a 16-ft. roadway.

BOONTON, N. J.—The Wrought Iron Bridge Co., of Canton, O., is reported to have been awarded the contract for a bridge at Washington St., as advertised in Engineering News, the contract price being $22,500, with a wood floor, or $30,000 if asphalt is used.

PATERSON, N. J.—Bids are asked until June 28 for building three iron bridges in this county. Wm. L. Whitmore, County Engr.

RUTHERFORD, N. J.—The freeholders of Bergen county are reported to have voted to pay half the cost of a $26,000 bridge to be built across the Passaic River at this place, Passaic county to pay the other half.

EASTON, PA.—M. H. Schall, Clk. County Comrs., writes us that the following bids were received for repairs to the highway bridge over the Lehigh River at Freemansburg, as advertised in Engineering News; plan B adopted and awarding of contract postponed until June 28

	Plans. A.	Plans. B.
Wrought Iron Bridge Co., Canton, O...	$33,000	$29,000
Havana Bridge Co., Havana, N. Y.....	.....	23,800
Iron Substructure Co., Columbus, O...	47,561	43,856
Detroit Bridge & Iron Works, Detroit..	*13,169	*18,713
Nelson J. Buchanan, Chambersburg, Pa.	28,800	26,500
New Columbus Bridge Co., Columbus..	.....	27,840
Variety Iron Works Co., Cleveland, O..	28,600	27,900
Lehigh Valley Const'n Co., S. Bethl'm.	22,363	21,504

* Ironwork only.

GREENSBURG, PA.—The "Press" of Greensburg, states that Messrs. Driver & Ranson, Pittsburg capitalists, have secured the Kensington bridge charter and plans prepared by the Burrell Improvement Co. for a bridge to span the Allegheny River at that place and will proceed at once with the work of construction. The bridge will be located somewhere near Valley Camp and will be built to accommodate wagons and the tracks for the street car line.

NORRISTOWN, PA.—The county commissioners received the following bids June 19 for the superstructures for new iron bridges, (1) Park, (2) Schwenksville, (3) Wissahickon, (4) Swamp and (5) Perkiomen:

	1.	2.	3.	4.	5.
Nelson & Buchanan ..	$995	$3,789	$1,689	$1,569	$995
Bennett & Opdyke.....	891	3,826	1,422	1,400	891
Iron Sub-Structure Co..	925	4,942	1,442	1,225	925
New Columbus Bdg Co	928	3,690	1,480	1,389	928
Groton Bridge Co.....	998	4,014	1,700	1,475	998
Horsehead Bridge Co..	1,135	4,187	1,896	1,716	1,135
King Bridge Co.....	1,050	3,850	1,900	1,825	1,050
Massillon Bridge Co...	....	5,000	....	....	....
Wrought Iron Bdg. Co.	1,030	4,000	1,700	1,550	1,030
Champion Bridge Co...	1,300	4,450	1,900	1,800	1,300
Bracket Bridge Co.....	1,010	3,700	1,700	1,600	1,010
Havana Bridge Works.	1,121	3,822	1,670	1,561	1,121
Owego Bridge Co.....	1,200	4,500	1,865	1,690	1,200
Maryland Steel Co.....	1,084	4,943	1,739	1,571	974
*Penn Bridge Co.....	$17.24	$26.49	$19.45	$17.24	$21.20
*J. Dennithorne & Son	17.32	28.25	23.00	20.53	17.32
*C. H. Fulmer & Co...	15.33	24.90	20.35	18.27	15.33
*Thomas Wood & Co..	15.25	26.00	20.37	18.75	15.95

* Per lin. ft.

PITTSBURG, PA.—Charles Davis, County Engr., and others have been appointed viewers for a proposed bridge across the Ohio River at Sewickley. It is pro-

posed to have the bridge constructed as a county bridge.

PITTSBURG, PA.—A correspondent writes us that the new 22d St. bridge will be the first of a series of free bridges. The Schultz Bridge Co. has the contract for the entire structure, and the Keystone Bridge Co. will build the channel spans of this bridge. Drake, Stratton & Co. have the contract for the foundations. The channel piers rest on a timber grillage, 30 × 66 ft., made up of eight courses of 12 × 12-in. pine spiked together with square spikes ⅝ × 18 ins., 625 spikes to a course. This was surmounted by a crib or box, in which was built the pier. The bottom of the river was dredged out to a depth of about 10 ft. The timber rests on gravel.

NORTH CAROLINA.—The arrangements which the Southern Ry. Co. is making for a deep-water connection at Norfolk, Va., will necessitate the use of the North Carolina R. R. division of the system, between Goldsboro, via Raleigh, to Greensboro, N. C., by the heavy through freight southbound trains. There are a half-dozen or more long bridges over Haw River and other streams on this line which will have to be either greatly strengthened or entirely supplanted by heavier and stronger structures. It is also reported that the light rails on about 150 miles of this division will also have to be replaced by heavier ones. Ch. Engr., C. M. Bolton, Washington, D. C.

MACON, GA.—The county commissioners are considering the construction of a wooden bridge about 300 ft. long, and estimated to cost about $1,000, at Fletcher's mill.

RICHLAND, IND.—The county commissioners are considering the construction of a new bridge across the Whitewater River, at the foot of Main St.

DUNDEE, MICH.—Bids are asked until June 29 for the construction of a 120-ft. span iron bridge over Saline River. F. C. Drake, Highway Comr.

BOONE, IA.—The county supervisors have voted to build a new bridge across the Des Moines River at Baird's Ford, about four miles south of this city, at an estimated cost of about $10,000.

DAVENPORT, IA.—The Davenport & Rock Island Bridge & Terminal Co. has deposited $500,000 in bonds with the German Trust Co., of Davenport, and it is stated that all work preliminary to the construction of the proposed bridge has been completed.

SIOUX CITY, IA.—The Combination Bridge Co., of this city, was incorporated in Nebraska June 19 with a capital stock of $2,500,000, to build a highway and railway bridge across the Missouri River; incorporators, Wm. Reynolds, W. C. Silverthorn and William Faxon, Jr. This is a reorganization of the Credits Commutation Co. The bridge will consist of two 470-ft. drawspans and two 500-ft. fixed spans, 25 ft. center to center of trusses, and will rest on masonry piers. The construction was begun in 1890 and has been several times suspended and then resumed. The Phoenix Bridge Co. has the contract for the superstructure and Sooysmith & Co. that for the substructure. Res. Engr., Lee Treadwell; Ch. Engr., J. A. L. Waddell.

ANTHONY, KAN.—Bids are asked until July 8, for building three highway bridges in Harper county: 96 ft., 106 ft. and 62 ft. long respectively. William Buffy, County Clk.

LEAVENWORTH, KAN.—The Missouri Valley Bridge Co. has been awarded the contract for constructing an iron bridge over the Platte River east of this city, at a cost of $4,200.

LYONS, KAN.—Bids are asked until July 3 for building four small county bridges. Robt. Findlay, County Clk.

BEATRICE, NEB.—The board of supervisors is reported to have voted to build 15 new iron bridges in this county, the longest one to be 170 ft., with 70 ft. of approach, and it is reported that bids are now being received for the construction.

ELLENDALE, N. DAK.—Bids are asked until July 1 for constructing a wooden or steel bridge to be known as the Norway and James River Valley bridge. S. V. Saunders, County Audr.

GALVESTON, TEX.—The Galveston Bridge & Terminal Co. was organized several months ago to build a bridge across Galveston Bay and about 50 miles of railway between Houston and Galveston. An option has been secured on some 450 acres of land for terminal grounds, and Eugene Sweeney, the principal projector, is quoted as stating that the necessary capital has about all been secured and that the construction will be commenced as soon as a bonus of $25,000 has been raised. The proposed bridge will be of steel of the plate-girder type, with 122 spans of 60-ft. each and one 214-ft. drawspan, with concrete piers throughout. The contract for the construction has been awarded to W. J. Sherman, Union Trust Bldg., St. Louis, Mo., Contracting Engr. of the Toledo Bridge Co.

HEMPSTEAD, TEX.—Bids are asked until July 4 for building a bridge over the Brazos River about four miles southwest of this city. The bridge will consist of one 252-ft. span, one 126-ft. span, and one 54-ft. span, with tubular piers. Engr., J. I. Boggs, Houston, Tex.; T. B. McDade, Clk. County Court.

WENATCHEE, WASH.—Bids will soon be asked, according to reports, for the construction of a bridge across the Wenatchee River about one-half a mile from its mouth, connecting Kittitas and Okanogan counties.

MITCHELL, ONT.—Bids are asked until July 6 for constructing the superstructure of an iron bridge at Toronto St. James M. Christie, Town Clk.

BUILDINGS.

BOSTON, MASS.—A mortgage for $295,500 has been placed on the Parker House, which is probably for the proposed improvement and extensions to the buildings. Archs., Winslow & Wetherell.

MEDFIELD, MASS.—Bids are asked until July 8 for constructing six brick buildings for the Medfield Insane Asylum. Arch., W. P. Wentworth, 8 Exchange Pl., Boston; Ira G. Hersey, Wm. O. Blaney and J. G. Park, Com., Chamber of Commerce Bldg., Boston.

PITTSFIELD, MASS.—Plans are asked until July 10 for a $85,000, a $15,000 and two $20,000 brick or stone school buildings. John C. Crosby, Chn. Com.

ALBANY, N. Y.—Bids are asked until July 8 for repairing the interior of the state armory building. Arch., I. G. Perry, Capitol Bldg.; Adj. Gen., Edwin A. McAlpin.

BROOKLYN, N. Y.—Bids are asked until July 2 for repairing portions of three school buildings, and for heating and ventilating school building No. 46. John McNamee, Chn. Com.; John R. Thompson, Chn. Com. Heating and Ventilating.—The following bids were received by the supervisors June 17 for court house work: For enlarging the court house, K. A. Murphy, $109,400; T. B. Rutan, $98,922; Charles Hart, $87,059; P. J. Carlin & Co., $111,407; John Anderson Sons, $106,897; J. J. Cashman, $93,920; J. H. O'Rourke (including heating and ventilating), $114,000; F. J. Kelly, $103,392; W. J. Moran, $119,114; J. R. Kelly & Co., $107,000. For heating and ventilating, Gillis & Geoghan, $14,725; Germain Steam Heating Co., $14,000; Baker, Smith & Co., $10,938; Blake & Williams, $13,677; J. W. Birkett & Co., $13,680; R. Hussler, $13,483; Phillips, Doop & Co., $15,231; Donegan & Swift, $15,373.

NEW YORK, N. Y.—Bids are asked by the department of public parks until July 3 for constructing a new roof over the gallery and ground floor tanks for the aquarium in the Castle Garden building.—Bids are asked until July 3 for the laying of a new floor, repairs, etc., at the state arsenal, 35th St. and Seventh Ave. Gen. Benjamin Flagler, Ch. Ordnance.—Mrs. Elizabeth McDonald has leased 39, 41 and 43 West 42d St. to a syndicate for 30 years, and on this property it is proposed to erect a 16-story office building.

ROCHESTER, N. Y.—Bids are asked by the board of managers until July 1 for erecting a chapel for the State Industrial School, the building to include iron and steel work. Archs., Nolan, Nolan & Stern, Rochester.

TRENTON, N. J.—Bids are asked until July 8 for constructing a cell house to contain 200 steel cells, and a hospital building for the state prison. Arch., Thomas Cressey, 800 Broad St., Newark; E. J. Anderson, Pres. Com.

ALLEGHENY, PA.—An observatory to cost $150,000 is to be erected in Riverview Park by the Western University of Pennsylvania.

MORGANTOWN, W. VA.—Bids are asked until July 6 for erecting a brick church building. Arch., J. E. Allison, Penn Bldg., Pittsburg; J. S. Stewart, Chn. Com.

ATLANTA, GA.—Bids are asked until July 1 for erecting the Alabama building at Piedmont Park. Archs., Charles Wheelock & Son, of Birmingham, Ala.; Grant Wilkins, Ch. of Construction.

NEW ORLEANS, LA.—Bids are asked until July 1 for erecting three brick school buildings. John Fitzpatrick, Mayor.

CLEVELAND, O.—Bids are asked until July 20 for erecting two four-room school buildings. H. Q. Sargent, School Dir.

CHICAGO, ILL.—Bids are asked by the committee on buildings until July 12 for repairs to sundry school buildings. Ch. Engr., T. J. Waters, Schiller Bldg.—Julius Speyer has prepared plans for Paul Knefel for an eight-story brick and stone warehouse on Harmon Court, between State and Wabash Aves. The interior of the building will be of steel and finished with a view to its occupancy as a storage warehouse. The estimated cost is $60,000.

HELENA, MONT.—Bids are asked until July 15 for constructing two vaults in the court house, and for furnishing two doors for the vaults. T. S. Tooker, Clk. Lewis County.

HOUSTON, TEX.—Bids are asked until July 16 for erecting a court house and county jail building. Arch., Eugene T. Heiner; John G. Tod, County Judge.

LOS ANGELES, CAL.—Bids are asked until Aug. 12 for constructing an addition to the county farm building. T. E. Newlin, County Clk.

TORONTO, ONT.—Bids are asked until July 2 for erecting an addition to the Collegiate Institute building, Jarvis St. Archs., Curry, Baker & Co., Victoria St.; John Greer, Chn. Property Com.—Bids are asked until July 2 for repairing and enlarging four school buildings. W. W. Hodgson, Chn. Com.; C. H. Bishop, Supt. Bldgs.

WATER-WORKS.

AUBURN, ME.—Bids are asked by the water commissioners until July 1 for the purchase of $200,000 of 4% water bonds.

GORHAM, ME.—A committee of 11, including Stephen Hinckley, Geo. B. Emery and J. S. Leavitt, has been appointed to investigate the question of works and report upon plans for a supply.

KENNEBUNK, ME.—The petition of the Mousam Water Co. to construct works in this town was rejected at a special meeting last week, by a vote of 74 to 60. The village already has a small plant for fire protection, and appropriated $5,500 some time ago for extensions. The water company offered to purchase the present plant and materials for the extensions and to extend the service to West Kennebunk, provided 30 takers were secured. It is probable that the service will be extended to West Kennebunk at an early date.

ROCHESTER, VT.—This village is reported to have voted to raise $6,000 to secure a water supply for fire protection.

WEST DERBY, VT.—This village has voted to secure a supply from the Newport works for fire protection.

WEST RUTLAND, VT.—The special committee of ten has reported that works with about 11 miles of pipe and 40 hydrants would cost about $40,000. The district cannot issue more than $10,000 in bonds without permission from the legislature, and it has finally been voted to see what terms can be secured from a corporation willing to construct works. J. E. Manley is interested. J. E. Burke, Clk. Com.

AMESBURY, MASS.—The water company is reported about to purchase a new pump and to make extensions.

HAVERHILL, MASS.—The contract for building the pumping station in Mill Vale has been awarded to John M. Roche, at $10,980.

MALDEN, MASS.—The council is considering an additional appropriation of $15,000 for extensions.

NORTH ADAMS, MASS.—The committee is reported to have rejected all the bids received for constructing the new reservoir, and it is stated that the work will be done by the district, under the direction of David M. Greene, Engr., of Troy.

PITTSFIELD, MASS.—The council has appropriated $4,800 for extending the water main in South St.

SHARON, MASS.—The town has voted to offer the water company $40,000 for the works, and if this is refused to take the plant and leave the price to three commissioners. The town previously offered $35,000 for the plant, which the company offered to sell for $42,500.

WEBSTER, MASS.—The commissioners have been authorized to issue $20,000 in additional water bonds.

WELLESLEY, MASS.—The town has appropriated $15,000 for extensions of the works.

WINCHENDON, MASS.—At a town meeting June 18 it was voted not to adopt the report of the water committee. It is stated that the estimated cost was too great.

WORCESTER, MASS.—The council has voted to take Kettle Brook as an additional water supply in accordance with the recent legislative act authorizing the city to issue $500,000 in bonds for a new supply.—The committee has voted to make extensions in several streets and to request the council for a loan of $50,000 for extensions.

HARTFORD, CONN.—A bill has been introduced in the legislature directing this city to extend its service to West Hartford.

ALBANY, N. Y.—Bids are asked until July 1 for constructing foundations for two pumping engines and for laying 1,400 ft. of 6-in. pipe in Washington Ave. Geo. I. Bailey, Supt.

ANGELICA, N. Y.—It is stated that owing to a large number of recent fires steps are being taken to secure works.

BALLSTON SPA, N. Y.—Harvey M. Geer has reported plans for a better water supply. The plan recommended as the better one, and which the trustees unanimously approved, provides for new works, estimated to cost about $70,000.

BROOKLYN, N. Y.—The contract for remodeling the Ridgewood pumping station, including new pumping engines, etc., is reported to have been awarded to Henry R. Worthington, at $385,000.

BUFFALO, N. Y.—The committee has reported in favor of awarding the contract for building a new intake tunnel to Anderson, Barr & Usher, of New York, at their bid of $69,450. The total bids were published in our issue of June 13.

CLAYTON, N. Y.—R. P. Grant, G. H. Strong and H. E. Morse have been appointed a committee to investigate the question of works, roughly estimated to cost about $40,000.

CAIRO, N. Y.—The "Herald" of this place is agitating the question of better fire protection.

DELHI, N. Y.—The village authorities are reported to have employed Mr. Peters, of Bloomsville, to report plans for securing an additional water supply and better fire protection.

DUNDEE, N. Y.—An election will be held July 1 to vote on the construction of works. Engr., Walter F. Randall, Syracuse.

DUNKIRK, N. Y.—Geo. W. Rafter, of Rochester, has recommended that the present dam be raised 10 ft.

GOWANDA, N. Y.—A special election was held June 25 to vote on the question of a water supply for fire protection for 10 years, and also on the purchase of a stone crusher and roller

HEMPSTEAD, N. Y.—The village board is considering several plans for works. There is also talk of purchasing the present system.

ISLIP, N. Y.—The town board has been petitioned to take immediate steps to secure a more adequate water supply.

JEFFERSON, N. Y.—The Jefferson Water-Works Co., noted last week, was incorporated June 21 with a capital stock of $1,000. Pres., Frank Lober.

LOWVILLE, N. Y.—The contract for constructing a reservoir has been awarded to Edward Goutremont, of Lowville, at $4,995.

MONTICELLO, N. Y.—M. La Tourette, Secy. Comrs., writes us that the contract for works, as advertised in Engineering News, has been awarded to the Wild Engineering Co., 39 Cortlandt St., New York, at $18,815. Engr., John A. Miller, of Goshen, N. Y.

NEW YORK, N. Y.—Bids are asked by the commissioner of public works until July 1 for a supply of hydrants and pipe.

PHILMONT, N. Y.—At the recent election to vote on an appropriation of $40,000 for works, 23 votes were cast for and 22 against the proposition.

PORT RICHMOND, N. Y.—A special meeting will be held this week to discuss a proposition for the construction of works. It is stated that a contractor offers to construct the plant and to accept bonds in payment.

POTSDAM, N. Y.—This place is reported as investigating the question of an additional water supply.

SING SING, N. Y.—The "Republican" of this city states that New Katonah is talking of constructing works, at an estimated cost of $8,000.

UTICA, N. Y.—The Utica Water-Works Co. is reported as contemplating the enlargement of reservoir No. 4 by adding 10 ft. to the height of the bank.

WILLIAMSVILLE, N. Y.—The taxpayers voted June 22 to put in a system of water-works, estimated to cost $20,000. The stand-pipe and gravity system will be used. The village will be bonded to pay the expense of the improvement.

ATLANTIC CITY, N. J.—The council has sold the $775,000 of 5% 30-year gold water bonds to Spencer, Trask & Co., of New York, at a premium of $36,275.

BORDENTOWN, N. J.—A committee has been appointed by the water company and the city council to take steps to secure a better water supply. Efforts are also being made to secure a franchise for a new company.

BEAVER MEADOWS, PA.—The Citizens' Water Co. has been organized with a capital stock of $4,000, and proposes to construct a reservoir and lay about four miles of mains. Pres., James Rowe; Secy., J. M. Stauffer.

HARRISBURG, PA.—The finance committee of the

common council has favorably reported an ordinance granting a franchise to the Cumberland Water Co., which proposes to furnish the city with not less than 2,000,000 gallons of water a day from Boiling Springs.

—The Paxtang Water Co., of this place, has been incorporated with a capital stock of $3,000, to operate in Paxtang, Dauphin county; Pres., Reuben Landermilch; Treas., Samuel Gardner, 1,311 North Third St., Harrisburg.

HAZLETON, PA.—The Diamond Water Co. is reported about to construct a 25,000,000-gallon reservoir.

KNOXVILLE, PA.—W. D. Grimes, of this place, is treasurer of the following four companies, each incorporated June 24 with a capital stock of $1,000: Chartiers Valley Water Co., to operate at McKee's Rocks; Elliott Water Co., to operate at Elliott; Sheraden Water Co., to operate at Sheraden; Esplen Water Co., to operate at Esplen.

MARIETTA, PA.—The Marietta Gravity Water Co. has voted to relay the main across the river, broken by ice last winter. The work will require considerable blasting, and will cost about $10,000. The construction will be commenced at once.

PHILADELPHIA, PA.—Bids are asked until July 2 for four steel-plate air chambers and four steam separators, to be delivered at the Queen Lane pumping station. Thos. M. Thompson, Dir. Pub. Wks.

PHILADELPHIA, PA.—The director of public works has directed that plans be prepared for strengthening the Queen Lane reservoir, for which $250,000 was recently appropriated. The work will be done as soon as possible

SCRANTON, PA.—The Capouse Water Co. was incorporated June 24 to supply water in this city; capital stock, $5,000, commencing with $500. Treas., John T. Richards, Scranton.

WILMINGTON, DEL.—The commissioners are reported to have contracted for the rebuilding of the Worthington pump, so as to increase its capacity from 5,000,000 to 7,250,000 gallons, at a cost of $15,000.

WASHINGTON, D. C.—Bids are asked until July 11 for a new 30,000-gallon steel and iron water tank and trestle at Fort Meyer, Va. Maj., C. R. Barnett, Dept. Q. M.

HAMPDEN-SIDNEY, VA.—The trustees of the college have voted $3,000 for a water supply.

HAWKINSVILLE, GA.—It is reported that this city will have water-works and electric lights this summer. Sam Way, Mayor.

DEMOPOLIS, ALA.—John G. Chisholm, Cy. Clk., writes us that the contract for works has been awarded to Hebert & Lapeyre, of Chattanooga, Tenn., at $18,327, the other bids being Dunn & Lallande, $22,965; Thos. K. Gatchell, $20,500; Lee & Co., $19,795; Walton & Wagner, $19,528; J. N. Hazlehurst, $18,445.

SCRANTON, MISS.—At an election June 18 the water-works proposition was defeated for the second time. Only 72 votes were cast, of which 48 were against works.

ASHTABULA, O.—Benjamin A. May, of Chicago, has been appointed receiver for the Ashtabula Suburban Light & Water Co.

HAMILTON, O.—James R. Maxwell, Consult. Engr., has reported plans for improvements estimated to cost about $60,000. The work includes 12 driven wells, 24 and 12-in. cast iron pipe, and a 5,000,000-gallon pumping engine. John Fisher, Secy. Water Bd.

LORAIN, O.—An election will be held July 10 to vote on an issue of $125,000 in water bonds for improvements, as noted last week.

NATIONAL MILITARY HOME, O.—M. McCoy, Treas., writes us that the contract for sinking eight additional wells at the National Home has been awarded to the Wagner Water Supply Co., of Dayton, at $9,000. The bids were opened June 15.

FOWLER, IND.—An election has been held to vote on the question of works, estimated to cost about $20,000.

ROYAL CENTER, IND.—The town trustees are investigating the question of works, which, it is thought, can be constructed for $5,000. Daniel Vanneman and J. B. Runkle are interested.

CROSWELL, MICH.—The city voted some time ago to issue $9,000 in bonds for works, and the contract for sinking wells was awarded. After digging nearly 1,000 ft. the contractors threw up the contract, and it is stated that the council has resumed the work, secured a water supply and will lay mains at once.

JACKSON, MICH.—An election will be held July 8 to vote on an issue of $50,000 in bonds, including $17,500 for water extensions.

LAKE ANN, MICH.—The Michigan Pipe Co., of Bay City, has been awarded the contract for works, which will consist of 4,000 ft. of 3-in., 1,800 ft. of 4-in., 950 ft. of 5-in., and 600 ft. of 6-in. pipe, with nine hydrants. The improved Wyckoff water pipe is to be used, the water supply to be obtained from a spring. C. H. Thomas, Cy. Clk.

PETERSBURG, MICH.—It is stated that this place is seriously agitating the question of works.

ARLINGTON, ILL.—A press report states that works will be constructed at a cost of $55,000, for which the council has voted to issue bonds.

BELVIDERE, ILL.—The Epworth Camp Meeting Association is considering plans for water-works at the camp ground. A. C. Fassett, of this city, is interested.

CHENOA, ILL.—A press report states that an election was held June 20 to vote on an issue of bonds for works.

FORT SHERIDAN, ILL.—Bids are asked until July 2 for constructing works, according to reports. Clk., H. E. Evans, Highwood, Ill.; Engr., H. L. Bowen, Highland Park, Ill.

MONMOUTH, ILL.—Bids are asked until July 8 for furnishing materials and laying 6,000 ft. of 4-in. and 5,000 ft. of 6-in. water pipe, as stated in our advertising columns. Thos. S. McClanahan, Cy. Engr.

SORENTO, ILL.—The village board is reported to have contracted with a Mr. Williams to construct a reservoir and lay mains through the principal street.

VIRGINIA, ILL.—The Virginia Water & Power Co. has been incorporated with a capital stock of $60,000 by Geo. Conover, J. A. Jones, R. W. Mills and others.

WARREN, ILL.—The citizens are reported to have voted to issue bonds for works, and the question is now being investigated. Address P. T. Hicks, Cy. Engr.

WENONA, ILL.—Bids are asked until July 11 for furnishing materials and laying water mains. Engr., Geo. C. Morgan, New York Life Bldg., Chicago. John T. Judd, Cy. Clk.

BELMONT, WIS.—An election will be held July 10 to vote on an issue of $3,000 in bonds for works.

DEERFIELD, WIS.—I. O. Brietson, Village Pres., writes us that $5,000 in bonds have been voted for works, and that the contract for the construction will soon be awarded. A gasoline engine will furnish the power. Fairbanks, Morse & Co., of Chicago, prepared the plans.

INDEPENDENCE, WIS.—The contract for works is reported to have been awarded to A. J. Bantch, of Independence, at $5,244. An 8-in. artesian well is being sunk, the present depth being over 400 ft.

SHULLSBURG, WIS.—Plans are being prepared for works. The supply will be from springs and pumped to a steel tank to be erected on a 50-ft. tower.

ARMSTRONG, IA.—At a town meeting June 18 it was voted to construct works, at an estimated cost of $5,000.

DOON, IA.—An election has been held to vote on an issue of bonds for works.

INDIANOLA, IA.—The council is reported as considering a proposition for the construction of works.

MALCOLM, IA.—F. A. Hubbert, Cy. Recdr., writes us that the contract for works has been awarded to Jackson & Morse, of Des Moines, at about $4,500.

OELWEIN, IA.—W. S. Huntington, of Oelwein, is preparing plans for works in this city to cost about $14,000, for which bonds have been voted.

SIOUX CITY, IA.—The council is considering plans for extending the mains to supply Morning Side and Fairmount Ave., at an estimated cost of $20,000.

AMBOY, MINN.—Bids are asked until July 10 for constructing works, which will include an elevated tank, 1,500 ft. of 6-in. pipe and 7 hydrants; estimated cost, $5,000. Fairbanks, Morse & Co., of St. Paul, prepared the plans. L. E. Cross, Village Recdr.

DULUTH, MINN.—There is talk of calling a special election to vote on the purchase of the Duluth and West Duluth systems. The plans include extensions of the plants, which would employ about 1,000 men during the winter months.

PRINCETON, MINN.—Bids are asked until July 5 for the purchase of $19,000 in water-works and electric light bonds. J. W. Hartman, Recdr., writes us that the plans for works have been prepared by C. F. Loweth, of St. Paul.

WINDOM, MINN.—Bids are asked until July 19 for the purchase of $33,000 in 20-year 5% water and electric light bonds. F. W. Force, Cy. Recdr.—Plans for works are being made by Chas. F. Loweth, of St. Paul.

ALBANY, MO.—The city is reported as wishing to grant a franchise for works. Address W. L. Millen.

UNION, MO.—Bids are asked until July 20 for the construction of works. Consult. Engr., Wm. H. Bryan, Turner Bldg., St. Louis.

SANTA CLARA, CAL.—C. E. Moore, Cy. Engr., writes us that the contract for works, except wells, as advertised in Engineering News, was awarded June 11 to the General Construction Co., of San Francisco, at $40,717, and that for four 10-in. wells 200 ft. deep to J. H. Loring, of Santa Clara, at $960. The contract for works calls for 23,300 ft. of 12 to 4-in. cast iron and 48,400 ft. of 3 and 2-in. wrought iron pipe, a steel tower 80 ft. high, with 180,000-gallon tank, two 1,250,000-gallon pumping engines, two 65-HP. boilers, 15 hydrants, and moving 34 hydrants. The other bidders were as follows: Pacific Bridge Co., San Francisco; Dow Steam Pump Works, San Francisco; Risdon Iron & Locomotive Works, San Francisco; Johnson & Peterson, Oakland; Sykes Construction Co., San Jose; Fulton Engineering & Shipbuilding Works, San Francisco; Cotton Bros. & Co., Oakland; W. T. Garratt & Co., San Francisco. For boring wells: C. Munch, Stockton. For power house, tower and tanks: Johnson & Peterson, Oakland; Morrison Bros., Santa Clara; A. J. McIlvain and Louis Heckelman, of Santa Clara. For pipe, valves and hydrants: Robt. Menzel, Santa Clara; Dalzell & Moller, San Francisco; Crane Co., San Francisco; Jas. Kersell, Santa Clara; Holbrook, Merrill & Stetson, San Francisco; Greenberg & Co., San Francisco. For laying pipe: L. C. W. Otto, San Jose; Doyle & Brookbank, San Jose; Purcell & Thompson, Oakland; P. H. McEvoy, Menlo Park; Chas. Wehner, San Jose; David Turner, Jr., Clyde, Kan. For boilers and pumping machinery: A. L. Fish, San Francisco; Park & Lacey Co., San Francisco; Gardner Governor Co. (partial bid).

CHATHAM, ONT.—The council has voted to accept an offer of the Chatham Water-Works Co. to sell its plant to the city for $145,000. It is reported probable that the taxpayers will vote to make the purchase.

IRRIGATION.

OMAHA, NEB.—Press reports state that a preliminary survey is being made and will be finished at an early day for an irrigation ditch 16 miles long through the eastern part of Buffalo and the western part of Hall counties. The ditch will tap the Platte River 10 miles southwest of Shelton, passing through some of the most productive land in the great Platte valley. It will be 24 ft. wide at the bottom, and will carry sufficient water to irrigate over 15,000 acres of land.

ORD, NEB.—J. A. Patton and others have petitioned for permission to organize an irrigation district about 3½ miles wide along the North Loup River. V. Kokes, County Clk.

BROWNWOOD, TEX.—A local company has been organized to build a dam across the Pecan Bayou River for irrigating 40,000 acres. Surveys are now being made, and it is probable that work will begin within a few months. Henry Ford is interested.

NEW COMPANIES.—Anawoshpa Irrigation Co., Seattle, Wash.; $200,000; Edward S. Austin, Alvin A. Batcheller, Robert Moran, David J. Longstaff.

Steamboat Ditch Co., Gering, Neb.; $1,000, with $100 paid in; to construct irrigation canals; William French, J. P. Wood, W. B. Davis, G. M. Crabill.

Appleton Land & Water Co., San Bernardino, Cal.; $500,000, with $210,000 paid in; to take water from the Mojave River by means of canals, reservoirs and dams to irrigate the lands lying east of Hisperia and Victor; Pres., D. P. Hatch, of Los Angeles; Secy., L. E. Palmer.

SEWERAGE.

FARMINGTON, ME.—A special town meeting was held June 24 to vote on the question of constructing a system.

NASHUA, N. H.—It is reported that about 3,850 ft. of sewers will be constructed this year.

ROCHESTER, N. H.—The council has appropriated $20,000 for sewers in East Rochester, and has voted to advertise for bids for the construction. Engr., Ernest W. Bowditch, of Boston.

EAST HAMPTON, MASS.—The town has voted $6,500 for sewers in a number of streets.

LOWELL, MASS.—The committee has voted to recommend the construction of sewers in 14 streets.

NATICK, MASS.—Ross & Simonds, of Waltham, have been awarded the contract for building the sewage pumping station at West Natick.

PITTSFIELD, MASS.—Bids are asked until July 10 for constructing 1¾ miles of pipe sewers; also separate bids for sewer materials, as stated in our advertising columns. Ernest W. Bowditch, Engr., 60 Devonshire St., Boston.

QUINCY, MASS.—The following estimates for a system have been prepared: Norfolk Downs, Atlantic and Wollaston, $37,740; Norfolk Downs and Atlantic, $24,371; Wollaston and Montclair, $10,220; Quincy Center, South Quincy and Quincy Point, $70,918; South Quincy, $17,405; Quincy Point, $18,540; West Quincy, $20,553; total, $199,767; brick pumping station, $17,000; pumping plant with a capacity of 5,000,000 gallons per day, $24,000; force main and outfall to connect with Moon Island sewerage system, $51,000; land damages, $27,300; grand total, $319,067.

WINCHESTER, MASS.—Bids are asked until July 2 for constructing about three miles of pipe sewers, as stated in our advertising columns. Ernest W. Bowditch, Engr., 60 Devonshire St., Boston.

BRIDGEPORT, CONN.—It is proposed to construct sewers in six streets. F. C. Mullins, Cy. Clk.

NEW BRITAIN, CONN.—Petitions have been presented for sewers in two streets.

NEW HAVEN, CONN.—The committee has voted to recommend the construction of sewers in three streets.

ROCKVILLE, CONN.—It is reported that the plans for a system now being prepared by S. M. Gray, of Providence, are nearly completed. The city will soon advertise for bids for sewers in Union and Prospect Sts. The council will sell $50,000 of 4% 30-year bonds early in July for sewer purposes.

AVON, N. Y.—An election will be held June 28 to vote on the question of constructing a system estimated to cost $12,000. Alva Carpenter, Stephen Hosmer, Elijah H. Clark, E. R. Wright and E. A. Nash compose the committee.

BROOKLYN, N. Y.—Bids are asked until July 9 for constructing a sewer in Driggs Ave. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—Bids are asked until June 9 for constructing 18 and 12-in. pipe and 78 to 33-in. brick sewers, estimated to cost about $63,000. R. G. Parsons, Secy. Dept. Pub. Wks.

CLINTON, N. Y.—Wm. W. Cook, of Junction City, Kan., has been awarded the contract for constructing a system, as advertised in Engineering News, at $10,895. The other bidders were as follows: J. J. Siegrist, Utica, $19,491; J. K. Baxter, Utica, $18,843; Rogers & Fitzpatrick, Plattsburg, $14,986; J. H. Clements, Schenectady, $13,736; L. D. Halbert, Syracuse, $12,492; Dodge & McGregor Buffalo, $15,643; Abbott Gamble Construction Co., St. Louis, $11,900; Munson & Lewis, Herkimer, $12,664; William Franklin, Buffalo, $14,597; Jenkinson & Nicholson, Port Huron, Mich., $10,250. Engr., A. M. Scripture, of New Hartford, N. Y.

DUNKIRK, N. Y.—It is proposed to construct 15-in. pipe sewers in two streets. J. F. Maloney, Cy. Clk.

ITHACA, N. Y.—The bids received for 3,875 lin. ft. of 14-in. cast iron pipe, and 6,175 lin. ft. of 14-in. wooden pipe outfall sewer, have been rejected and the work will be readvertised. Henry N. Ogden, Ch. Engr.

NEW YORK, N. Y.—Bids are asked by the department of public parks until July 8 for constructing sewers in three streets.

SYRACUSE, N. Y.—Bids are asked until July 1 for constructing a 12-in. pipe sewer in Ash St. H. F. Stephens, Cy. Clk.

TROY, N. Y.—Bids are asked until July 2 for constructing a brick sewer in Spring Ave. E. O. Ross, Secy. Comptroller's Office.

BLOOMFIELD, N. J.—Bids are asked until July 8 for laying about 7,283 ft. of 8-in. and 3,279 ft. of 20-in. sewer pipe, as stated in our advertising columns. Engr., A. H. Olmstead; Wm. L. Johnson, Township Clk.

ORANGE, N. J.—The council has voted to issue $125,000 of sewer bonds for the completion of the system in 58 of the streets of the city. The system so far has cost $947,000, and this additional sum will sewer all the remaining streets.

EMPORIUM, PA.—C. W. Shaffer, Borough Secy., writes us that the following bids were received June 15 for constructing sewers, as advertised in Engineering News; contract will probably be awarded to Andrew Reilley on July 1:

Andrew Reilley, Smethport, Pa.	$4,353
Thos. Nicholson, Port Huron, Mich.	4,490
L. M. Morrison, Lock Haven, Pa.	4,601
Dodge & McGregor, Buffalo, N. Y.	4,706
Thos. F. Moore, Buffalo, N. Y.	4,754
Thos. McGuigan, Meadville, Pa.	4,955
Sanders & Houston, Pittsburg, Pa.	5,110
Hite & Hughes, Clearfield, Pa.	5,171
J. H. Havens, Emporium, Pa.	5,300
Ulrich, Nissley & Williams, Springfield, O.	5,547
P. J. Cleary, Shenandoah, Pa.	5,617
O. N. Gardner, Jamestown, N. Y.	5,631
W. H. Cookman, Niagara Falls, N. Y.	5,794
R. M. Overhiser, Emporium, Pa.	5,903
J. McCloud & Co., Williamsport, Pa.	6,029
D. E. Kendig, Johnsonburg, Pa.	6,718
McConegley & Bennett, Greensburg, Pa.	6,862

PLAINFIELD, N. J.—Bids are asked until July 8 for 32,000 ft. of 4-in. house connections, as stated in our

advertising columns. Engr., A. J. Gavett; Jas. T. MacMurray, Cy. Clk.

BRADFORD, PA.—Bids are asked until July 1 for constructing 4,300 ft. of 15 to 10-in. pipe sewers in the 11th sewer district. P. B. Winfree, Cy. Engr.

PHILADELPHIA, PA.—Bids are asked until July 8 for the purchase of $1,200,000 in 3% sewer and public improvement bonds. Chas. F. Warwick, Mayor.

SWARTHMORE, PA.—Bids are asked until July 15 for constructing 11,000 ft. of sewers. Thos. G. Janvier, Borough Engr., Lansdowne; Richard T. Ogden, Chn. Highway Com.

WILMINGTON, DEL.—Bids will soon be asked for constructing sewers. T. C. Hatton, Engr.; Harvey J. Wiley, Secy. St. Dept.

BALTIMORE, MD.—The mayor has signed an ordinance authorizing the construction of a sewer in Preston St. and Addison Alley, at an estimated cost of $50,000.

WASHINGTON, D. C.—C. G. Stone, Fred Alexander and T. F. Felter have petitioned the district commissioners for additional sewers in Brightwood.

CINCINNATI, O.—Bids are asked by the board of administration until July 2 for constructing sewers in Mill St.

DAYTON, O.—Bids are asked until July 2 for constructing about 3,200 ft. of 8-in. pipe sewers. C. A. Herbig, Cy. Comptroller.

LOGAN, O.—B. K. Tritsch, Secy. Trustees, writes us that $15,000 has been appropriated for sewers, for which Frank Snyder, of Columbus, is preparing plans.

INDIANAPOLIS, IND.—Bids are asked until July 6 for constructing 398 ft. of 12-in. pipe sewers. C. C. Brown, Cy. Engr.——Bids will be received about July 20 for sewers in two streets and one alley.

ST. JOHN'S, MICH.—An election is to be held to vote on the question of issuing $55,000 in bonds for purchasing land for sewerage purposes, and for purchasing the electric light plant.

GALENA, ILL.—It is proposed to construct a sewer, at an estimated cost of about $5,000. J. B. French, Cy. Clk.

MAYWOOD, ILL.—S. H. Donaldson, Jr., Village Clk., writes us that C. W. Maynard, of Maywood, was awarded the contract for constructing sewers, at $7,100. C. M. Porter, of Maywood, was the next bidder, at $8,000.

PONTIAC, ILL.—W. J. Butler, Cy. Clk., writes us that it is proposed to construct about a mile of 18-in. pipe sewers.

RACINE, WIS.—Bids are asked by the board of public works until June 29 for constructing the first three sections of the Duck St. sewer.

FORT DODGE, IA.—The city clerk has been directed to advertise for bids for constructing sewers in eight streets.

MINNEAPOLIS, MINN.—The council has decided to construct an 86-in. brick tunnel sewer in the Bryn Mawr district. J. C. Oswald has advanced $22,000 to aid in the construction.

OAKLAND, CAL.—It is reported that a large part of the territory east and north of Lake Merritt is soon to be sewered. It is estimated that the work will cost $40,000. The sewer will drain into the estuary at First Ave. and East 11th St. Bids for the work will be asked by the council in a short time.

HAMILTON, ONT.—The committee has voted to recommend an appropriation of $500 to engage an engineer to report on the question of sewage disposal.

GARBAGE DISPOSAL.

CAMDEN, N. J.—B. F. Sweeten & Son have been awarded the contract for collecting garbage for the ensuing year, at $6,100, and that for street cleaning, at $5,700. The other bids for garbage collection were William Thompson, at $10,800, and Franklin Ward, at $11,000.

POTTSVILLE, PA.—Dr. A. H. Halverstadt and S. B. Briscoe, of the board of health, and several members of the council visited Scranton last week and inspected the garbage crematory at that place.

CLEVELAND, O.—Dr. Hess, Health Officer, has been in Detroit investigating that city's method of garbage disposal.

FORT WAYNE, IND.—Bids are asked until June 28 for the erection of a garbage crematory. A. J. You, Clk. Bd. Pub. Wks.

STREETS AND ROADS.

LEICESTER, MASS.—The selectmen have awarded subcontracts for the second mile of state road, as follows: Excavating, laying telford paving and supervising, John O'Gara, of Spencer; drawing gravel and drawing stone to crusher, Gallagher & Barry; drawing stone from Jamesville and stone from crusher, Edward Warren.

NEW BEDFORD, MASS.—It is proposed to macadamize portions of three streets. W. S. Cook, Asst. Cy. Clk.

WAREHAM, MASS.—Local papers state that a decree has been prepared by the county commissioners providing for the building by the towns of Wareham, Plymouth and Carver of a road from Parker Mills, in Wareham, to Wankinco bog. The road will be about five miles long, and will give the cranberry growers of that region a highway.

EAST PROVIDENCE, R. I.—The contract for grading Broadway will probably be awarded by the council at its regular meeting in July.

ALBANY, N. Y.—Bids are asked until July 1 for paving Clinton Sq. with granite blocks. T. J. Lanahan, Clk. Bd. Contract. The board of contract has voted to pave portions of five streets with granite blocks and six with vitrified brick.

BROOKLYN, N. Y.—Bids are asked until July 10 for flagging portions of sidewalks in 20 streets. A. T. White, Comr. Cy. Wks. The paving committee of the council has voted in favor of paving portions of six streets with asphalt and one each with Belgian blocks and vitrified brick.

BUFFALO, N. Y.—Bids are asked until July 12 for paving portions of four streets. R. G. Parsons, Secy. Dept. Pub. Wks.

MIDDLETOWN, N. Y.—The council is considering a resolution authorizing the paving of Wickham Ave. with brick.

NEW YORK, N. Y.—Specifications have been completed for several important paving contracts in the northern part of the city; contracts for which will probably be awarded in about a month.

NEW YORK, N. Y.—Bids are asked by the department of public works until July 1 for flagging and grading three streets, and by the department of public parks until July 3 for 385 sq. yds. of flagging, 2,400 cu. yds. of earth and 900 cu. yds. of rock excavation, etc.

OSWEGO, N. Y.—The council has voted to make several street improvements, including the paving of a portion of one street with asphalt. Fred D. Wheeler, Cy. Clk.

SYRACUSE, N. Y.—Bids are asked until July 1 for laying asphalt, cement or flagstone crossings in 14 streets. H. F. Stephens, Cy. Clk.

WALDEN, N. Y.—The trustees are considering the question of paving Main St.

BELLEVILLE, N. J.—The township committee has sold $65,000 of 4% macadam road bonds to the Howard Saving Institution, of Newark, for $65,410.

JERSEY CITY, N. J.—The street and water board has designated 19 streets, parts of which will be immediately repaved with Belgian blocks, brick and asphalt, the expense to be paid from the license fund.

MORRISTOWN, N. J.—Bids are asked until July 16 for macadamizing county roads, as stated in our advertising columns. Engr., Wm. E. King, Landing, N. J.; Clk., J. C. White, Morristown.

NEWARK, N. J.—It is proposed to pave portions of six streets with granite blocks, two with brick, seven with asphalt and three with trap rock. A. M. Linnett, Bd. St. Comrs.

TRENTON, N. J.—Bids are asked until July 2 for curbing and paving sidewalks and gutters, etc., about the property of the state board of education, in this city. J. Bingham Woodruff, Chn. Com.

ALLEGHENY, PA.—Bids are asked until July 2 for the purchase of $800,000 of 4% street and sewer bonds. James Brown, Comptroller.——At a meeting of the committee on public works June 14 street and sewer improvements aggregating about $132,000 were awarded. The bids for asphalt paving were rejected, and the work will be readvertised under new specifications, which will permit the using of at least two different kinds of asphalt.

BRADFORD, PA.—The council has voted to pave Chautauqua Place with brick.

BUTLER, PA.—Bids are asked until July 10 for about 8,350 sq. yds. of grading and paving in Mifflin St. H. B. Coulter, Secy. Council.

PHILADELPHIA, PA.—Bids are asked until July 8 for the purchase of $1,200,000 of 3% paving, sewer and public improvement bonds. C. F. Warwick, Mayor.

PITTSBURG, PA.—The residents of the South Side are trying to secure an appropriation of $100,000 for a driveway from Carson St., at South 21st St., to the city line on Arlington Ave. or the Brownsville road. Several engineers are reported to have stated that the driveway could be built for this sum.

STROUDSBURG, PA.—The council is reported to have voted to improve Main St. at a cost of $20,000, and to have already purchased a stone crusher.

WASHINGTON, PA.—Bids are asked until July. 1 for laying 12,000 sq. yds. of vitrified brick pavement in East Washington. Address James A. Wiley.

WILKES BARRE, PA.—Bids are asked until July 5 for grading and paving portions of two streets with brick. I. M. Kirkendall, Chn. Com.; Frank Deitrick, Cy. Clk.

WILMINGTON, DEL.—Bids are asked until July 1 for furnishing 30,000 sq. yds. of vitrified brick or blocks, the brick to be not less than 8 ins. in length, 2½ ins. in thickness and 4 ins. in depth. Harvey J. Wiley, Secy. Street Dept.

BALTIMORE, MD.—Bids are asked until July 1 for grading and paving three streets. H. T. Douglas, Cy. Comr.

ALEXANDRIA, VA.—Bids are asked until July 6 for grading the west end of Fraser Ave. in Jefferson district, Alexandria county. Frank Horne, Chn. Supervisors.

CHATTANOOGA, TENN.—The Southern Construction Co. has offered to pave Oak St. with brick and receive its pay at the pleasure of the city. The city engineer estimates that the work would cost $41,650, of which the railway company would pay $14,100. The proposition was referred.

AVONDALE, O.—Bids are asked until July 5 for improving Woodward Ave. W. E. Wynne, Corp. Clk.

CINCINNATI, O.—Bids are asked by the board of education until July 8 for building a retaining wall, grading and cementing yard, etc. J. E. Cormany, Chn. Com.——We are informed that plans have been made for paving several streets, but that no contracts have been awarded, as the pavement fund out of which one-half the cost was to have been paid has been exhausted. Some of these streets will be improved and the property owners assessed for the whole cost.

CLEVELAND, O.—Bids are asked until July 3 for furnishing and laying a large amount of stone flagging. D. E. Wright, Dir. Pub. Wks.

COLUMBUS, O.—The American Asphalt Co. has been awarded the contract for paving Linwood Ave. with asphalt on 6 ins. of concrete, at $21,127.

INDIANAPOLIS, IND.—Bids are asked until July 2 for 6,161 sq. yds. of asphalt paving, for 2,775 lin. ft. of brick sidewalks and 7,650 lin. ft. of cement sidewalks, and until July 6 for grading and gravelling 755 lin. ft. of an alley. C. C. Brown, Cy. Engr.

GRAND RAPIDS, MICH.—The city engineer has reported the following estimates for paving a portion of Pearl St., 330 x 38 ft.: With asphalt, $4,477; brick on concrete, $2,909; cedar blocks on concrete, $2,612.

JACKSON, MICH.—The council has voted to pave East Main St., at a cost to property owners of $18,700, and Mechanic St., to cost $10,700.

LANSING, MICH.—Bids are asked until July 6 for 17,018 sq. yds. of brick paving, with 8,609 lin. ft. curbing, etc., as stated in our advertising columns. J. A. Davis, Cy. Engr.; E. O. Sellers, Supt. Pub. Wks.

LE ROY, ILL.—A new road 4½ miles long will be laid out in this township.

OHICAGO, ILL.—Bids are asked until July 1 for improving 11 streets and alleys. W. D. Kent, Comr. Pub. Wks.

MATTOON, ILL.—Bids are asked until July 5 for 24,000 sq. yds. of brick paving and about $4,000 worth of sewer work. M. B. Fitch, Cy. Engr.

PONTIAC, ILL.—W. J. Butler, Cy. Clk., writes us that the city proposes to do some paving this year.

SPRINGFIELD, ILL.—The council has passed ordinances for repaving several streets, at an estimated cost of about $80,000.

DUBUQUE, IA.—Bids are asked until July 1 for 3,300 sq. yds. of brick paving on a macadam grout foundation, and for 4,000 sq. yds. of macadam paving, with 3,800 lin. ft. of curbing, etc. T. J. Cooney, Cy. Recdr.——The following bids were received for improving West Eagle Point Ave.: Steuck & O'Farrell (awarded contract), $12,763; Ryan Bros., $12,999; J. Pickley, $14,609; E. E. Frith, $13,497; Brown & Brown, $13,865; D. W. Linehan, $14,031; John Blake, $12,990.

IOWA CITY, IA.—The council has adopted resolutions providing for brick pavements. Chas. S. Magowan, Cy. Engr.

ROCK RAPIDS, IA.—A contract has been awarded to Sioux Falls parties for grading and improving Main and intersecting streets. J. M. James, Cy. Engr., Sioux Falls, S. Dak., is in charge of the work.

HELENA, MONT.—The county commissioners have voted to build a new road to Lump City and adjoining mining districts, by way of Unionville. It is stated that the construction will be commenced July 24 under the direction of Joseph Davis and Philip Constans as viewers, and Paul S. A. Bickel as surveyor.

TACOMA, WASH.—It is proposed to pave Pacific Ave. with fir blocks on a concrete foundation.

PORTLAND, ORE.—A report states that the Willamette Valley & Cascades Mountain Wagon Road Co. is to be allowed by the government to make a deposit and have the balance of its grant surveyed. The forest reserve, where this grant crosses it, is 24 miles wide. The width of the grant, as it crosses the reserve, averages 15 miles, and extends from Sweet Home to Camp Polk. The company will have to deposit about $20,000 to pay for this survey, which it is intended to have completed this fall.

MANUFACTURING PLANTS.

NORTH ADAMS, MASS.—A press report states as follows: The largest cotton mill in America is to be built at once in Adams. This was decided at a meeting of capitalists June 21. The mill will have 80,000 spindles and 2,100 looms, and will cost $1,000,000. It will be 425 ft. long and 116 ft. wide, with an L, and will be five stories high. The concern is brought to Adams by the Plunkett Bros., and some of the richest capitalists in the country are interested in it. Pres., Edw. N. Gibbs, of Norwich, Conn.; Treas., W. B. Plunkett, of Adams; Clk., C. T. Plunkett, of Adams; directors, Edw. N. Gibbs, of Norwich, Conn.; Theodore A. Havemeyer, of New York; David A. Wells, of Norwich, Conn.; Wm. H. Hallé, of Springfield, Mass.; Gardner Hall, Jr., of South Wellington, Conn.; Stephen A. Jenks, of Pawtucket, R. I.; W. F. Draper, of Hopedale, Mass., and W. B. Plunkett, and C. T. Plunkett, of Adams, Mass.

WORCESTER, MASS.—A press report states as follows: Akers & Taylor, the Charlton City woollen manufacturers, have closed a contract for the erection of a shoddy mill of practically all steel construction. The new mill will be built on the site of the one burned a few weeks ago and located about three-quarters of a mile south of the firm's principal mills. The new mill will be 40 × 60 ft., will have a steel frame and roof, and exterior of corrugated iron. Three new pickers have been ordered. The building will be completed by Aug. 1.——The Wachusett Mills, H. W. Smith, Pres., with plant located on Bradley St., and with fancy cotton weaves as manufacturing specialties, has decided to add an additional story to its weave shed, and thereby double the capacity of the plant.

CONCORD, N. C.—A new cotton mill, to do both spinning and weaving and to be operated by steam power, is to be erected at this place by the Cannon Mfg. Co., which already owns several mills here. The main building is to be erected to accommodate 125 looms and 6,000 spindles at first with a view of enlargements in the future. Some 25 cottages for the operatives and several warehouses, etc., are to be erected. The plant will also include an electric light equipment.

HIGH POINT, N. C.—The plant of the Plaid mills at this place is to be increased by the erection of additional buildings and considerable new machinery for the manufacture of plaids, at an early day.——J. Elwood Cox will build and equip at once a new spoke and handle factory on the site of the present old factory.

ISLAND FORD, N. C.—A new cotton mill will be erected at once at this place, a small settlement on the Catawba River, three miles from Catawba Station, and 12 miles from Statesville, N. C., by Yount & Shrun, of Newton, N. C., and associates, who have formed a company with a paid-up capital of $50,000 for the purpose. The mill will be run by water power and will be equipped with about 5,000 spindles to begin with.

GREENSBORO, N. C.—Moses Cone, of New York, and associates, have purchased for $40,000 about 116,000 acres of land in Guilford county, N. C., for the purpose of erecting a number of cotton mills and other manufacturing plants. This land is situated near the town of Greensboro, a railway center, and the terms of sale provide that manufacturing plants to cost at least $250,000 shall be erected thereon within one year from date of sale. The Cone Export Co., as a corporation, is not interested in the matter.

MOUNT HOLLY, N. C.—A syndicate of New England capitalists has bought the old fair grounds at this place, and will, it is reported, build a large cotton mill thereon with a capacity of about 25,000 spindles. A. P. Rhyne, of Mount Holly, can furnish particulars.

JACKSON, MICH.—Claire Allen, Arch., is preparing

plans for a new factory for the Collins Mfg. Co., of this city, to replace the one recently burned. The factory will be 252 ft. long on Main St. and 218 ft. on Horton St., with another wing 244 ft. long. It will be 60 ft. in width and three stories in height and will be built of brick and made as nearly fireproof as possible.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

STONE CRUSHER.—Gowanda, N. Y.—The question of purchasing a stone crusher and roller was voted upon at a special election June 25.

CANAL WORK.—Albany, N. Y.—The governor has signed a bill appropriating $40,000 for repairs to locks on the Black River Canal.

LEVEE WORK.—Port Allen, La.—Bids are asked until July 3 for about 75,000 cu. yds. of levee work. A. D. Barrow, Secy. Comrs.

WHARF WORK.—Philadelphia, Pa.—The board of port wardens has approved plans for the extension of the city wharves and for the building of several new ones.

FIRE HOSE.—Baltimore, Md.—Bids are asked until July 8 for 11,400 ft. of 2½-in. fabric hose, and 3,500 ft. of 2½-in. gum hose. J. Alexander Preston, Pres. Fire Comrs.

STEEL RAILS.—Brooklyn, N. Y.—Bids are asked until June 28 for furnishing 400 gross tons of 70-lb. steel rails. C. C. Martin, Ch. Engr., New York & Brooklyn Bridge.

GAS PIPING.—Leamington, Ont.—Bids are asked until July 2 for gas piping and connections sufficient to pipe this town. Alex. Baird, Engr.; W. C. Coulson, Clk.

PARK SUPPLIES.—Baltimore, Md.—Bids are asked by the public park commission until July 5 for furnishing terra-cotta pipe, brick, lumber, stone, cement, etc. to the department for one year.

hydrants, and other supplies at the naval station at Port Royal, S. C., and at the Norfolk and Washington navy yards. Edwin Stewart, Paymaster General, U. S. N.

DREDGING AND JETTY WORK.—Aransas Pass, Tex.—The Baltimore, Md., "American" states that Alexander Brown & Sons, of that city, are considering a proposition for dredging and a system of jetty work for the improvement of the Aransas Pass harbor. It is stated that a land bonus of $840,000 has been guaranteed.

DAM.—St. Paul, Minn.—Capt. H. F. Hodges, U. S. Engr., has filed notice with the state auditor that the government is preparing to build a large reservoir on Gull Lake, which lies partly in Cass and partly in Crow Wing counties. The new dam will be located about seven miles west of Brainard, and a drainage area of 300 to 400 square miles will be effected, according to the report.

DREDGING.—Sandy Creek, N. Y.—Governor Morton has signed a bill appropriating $10,000 for dredging a canal from Lake Ontario into Wigwam Cove. The "News" of this city states that the canal will be located opposite the mouth of Little Sandy Creek, where the sand beach is only about 90 ft. wide and not very high. It is the intention of the state to open a waterway into Wigwam Cove, making the cove a harbor of refuge for vessels, and also to stimulate local commerce.

TELEPHONE FRANCHISE.—Sterling, Ill.—A franchise for a new telephone exchange has been granted to Aaron D. Hill, of Prophetstown, and others. The franchise is for 10 years, and it is stated that the prices will be $30, $18, and $12 for the use of business, residence and local instruments, respectively. The report states that Harrison telephones will be used, and that the service will be extended throughout Whiteside, Lee and Carroll counties, a portion of Henry county and to Clinton, Ia.

SEWER BRICK.—Minneapolis, Minn.—The following bids have been received for furnishing sewer brick, the price being per 1,000 brick:

Philip Riedele, sand mold sewer brick	$6.40
John S. Bower, 600,000 wire-cut sewer brick	6.64
John A. Berg, 200,000 wire-cut sewer brick	6.60
" " " 150,000 slop sewer brick	6.25
" " " 100,000 " " "	6.60
C. J. Swanson & Co., 300,000, wire-cut	6.25
N. P. Peterson, 500,000, side wire-cut, Minn. b'ck.	5.95
Northern Hydraulic Press Brick Co., 1,500,000	6.49

LAYING FLEXIBLE JOINT WATER PIPE.—Boston, Mass.—W. E. Swan, Secy. Water Bd., writes us that the following bids were received June 10 for laying flexible-joint water pipe in Boston Harbor:

Bidder.	Sections No. 1.[1] Per ft.		Sections No. 2.[2] Per ft.		Sections No. 3.[3] Per ft.	
G. W. Townsend	$2.97	*$10,395	$2.97	*$11,880	$4.92	$11,808
J. Cavanagh & Co.	3.83	13,405	4.85	19,400	6.25	15,000
Perkins & White.	4.10	14,350	4.30	17,200	4.75	*11,400

* Awarded contract. [1] 3,500 lin. ft. of 6-in. pipe, between Moon and Long islands. [2] 4,000 lin. ft. of 6-in. pipe, between Long and Gallops islands. [3] 2,400 lin. ft. of 4-in. pipe, between Long and Rainsford islands.

BRIDGE MASONRY.—Boonton, N. J.—The lowest bid for the stone work for the new 475-ft. bridge, as advertised in Engineering News, was that of Theodore Ringleib, Boonton, at $3.24 per cu. yd.

WATER-WORKS.—Montgomery, N. Y.—The awarding of contracts for constructing works, as advertised in Engineering News, was noted last week, as follows: Anniston Pipe & Foundry Co., for cast iron pipe; Eddy Valve Co., valves and hydrants; Henry R. Worthington, pumping machinery; Neff & Mitchell, of Newark, N. J., pipelaying; Struthers & Wells, R. H. Bethel, New York agent, stand-pipe, boilers and pumping station. Alexander Potter, Engr., New York, informs us that the detailed bids were as follows:

BIDS RECEIVED AT MONTGOMERY, N. Y., JUNE 14, FOR CONSTRUCTING WATER-WORKS.

Quantities.	Engineer's estimate.	Anniston Pipe Co.	Thos. McKenna.	R. D. Wood & Co.	Warren Fdry & Machine Co.	Chas. Millar & Co.	McNeal Pipe & Foundry Co.	Crane Co.	Eddy Valve Co.	Rensselaer Mfg. Co.	Mich. Brass & Iron Works.	Kennedy Valve Co.	Ludlow Valve Mfg. Co.	Pancoast & Hoges.	Thomas Doud.	Acock & Son.	R. H. Bethel.	John Morrell.	F. C. Cudworth.	Berkery & Tillinghast.	J. R. F. Kelley & Co.	Wilde Eng. Co.
Cast iron pipe:																						
8-in., w't 45 lbs.. 60.3 tons	$19.00	$19.55	$19.20	$20.00	$20.20	$20.50	$22.50	....	....	....	....	....	....	....	....	....	$19.55	$20.50	$21.00	....	$19.75	$20.50
6-in., " 33 " ..104.9 "	19.00	19.55	19.20	20.00	20.20	20.50	22.50	....	....	....	....	....	....	....	....	....	19.55	20.50	21.00	....	19.75	20.50
4-in., " 22 " ..108.0 "	19.00	19.55	20.80	20.50	20.20	21.00	22.50	....	....	....	....	....	....	....	....	....	19.95	21.00	21.50	....	20.26	20.50
*Special casting .. 1 ton	....	70.00	40.00	70.00	95.00	80.00	70.00	....	....	....	....	....	....	....	....	....	80.00	80.00	65.00	....	70.00	80.00
** " .. 5 tons	50.00	40.00	40.00	45.00	40.00	45.00	45.00	....	....	....	....	....	....	....	....	....	40.00	45.00	45.00	....	40.00	45.00
Total	$5,450	$5,611	$5,658	$5,759	$5,814	$5,960	$6,442	....	....	....	....	....	....	....	....	....	$5,664	$5,960	$6,106	....	$5,721	$5,907
Valves and hydrants:																						
8-in. hub, stop v. 7	$16.00	....	$17.00	$18.00	....	$16.98	....	$12.81	$16.50	$15.00	$15.00	$15.25	$16.98	$19.27	....	....	$12.81[a]	$16.98	$18.75[j]	....	$18.00	$16.50
6-in. " " 14	12.00	....	12.00	12.40	....	11.18	....	7.69	10.90	10.40	10.25	8.65	11.18	13.00	....	....	7.69[a]	11.18	12.10[j]	....	12.50	10.50
4-in. " " 9	7.00	....	8.00	7.60	....	6.75	....	5.13	6.75	5.98	6.75	5.80	6.75	8.50	....	....	5.13[a]	6.75	7.15[j]	....	7.60	7.00
8-in. valve boxes, 7	3.00	....	3.25	3.00	....	2.93	....	3.00	2.75	2.40	2.50	3.50	2.93	3.45	....	....	3.00[a]	2.93	2.75[j]	....	3.00	2.75
6-in. " " 8	3.00	....	3.25	3.00	....	2.93	....	3.00	2.75	2.40	2.50	3.50	2.93	3.45	....	....	3.00[a]	2.93	2.75[j]	....	3.00	2.75
4-in. " " 9	3.00	....	3.25	3.00	....	2.93	....	3.00	2.75	2.40	2.50	3.50	2.93	3.45	....	....	3.00[a]	2.93	2.75[j]	....	3.00	2.75
Hydrants, 2-nos., 20	22.50	....	22.50	23.00	....	23.20	....	21.04	22.65	....	21.75	22.75	23.20	22.48	....	....	20.50[a]	23.20	24.00[j]	....	22.50	22.00
Total	$1,067	....	$1,080	$1,107	....	$1,079	....	$926	$989	$305	$1,000	$1,024	$1,079	$1,128	....	....	$910	$1,079	$1,123	....	$1,094	$1,023

	Engineer's estimate.	Snow Steam Pump Co.	H. W. Merrill Pump'g Co.	H. R. Worthington.	Deane Steam Pump Co.	Sprackien Boiler & Machine Co.	Enterprise Boiler Co.	E. R. Pedrick.	Bromell, Schmith & Co.	Holyoke Steam Boiler Works.	Tippett & Wood.	Bailey & Co.	P. Delaney & Co.	Neff & Mitchell.								
Wells, rock, 440 ft.; earth, 180 ft.	$1,500	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	$1,346	....	....	....	$1,800	$1,300
Pipe laying, 8-in...2,680 ft.	.21	....	....	....	....	....	....	....	....	....	....	....	....	$0.17	$0.20	$0.25	.21	$0.23	$0.25	$0.30	$0.29	$0.25
" " 6-in...6,360 "	.19	....	....	....	....	....	....	....	....	....	....	....	....	.16	.18	.22	.18½	.19	.21	.25	.24	.18
" " 4-in...9,820 "	.17	....	....	....	....	....	....	....	....	....	....	....	....	.15	.16	.19	.16	.17	.18	.20	.17	.12
Rock excavation . 30 cu. yds.	1.50	....	....	....	....	....	....	....	....	....	....	....	....	2.00	1.50	1.50	1.50	2.50	3.00	3.00	1.50	2.00
Total	$3,441	....	....	....	....	....	....	....	....	....	....	....	....	$2,946	$3,252	$3,935	$3,311	$3,494	$3,763	$4,475[f]	$3,973	....
Pumping station,	$2,300	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	$3,456	$2,761	$2,500	....	....	....
Pumping machinery	1,000[1]	1,212[2]	....	$1,250[2]	$1,473[1]	....	....	....	....	....	....	....	....	....	....	....	....	1,155[3]	1,330	....	880	....
Boiler	900	1,210	....	1,200	1,562	....	....	....	....	....	....	....	$1,200	....	....	....	....	1,100	1,050	....	900	....
Total	$1,900	$2,422	$2,425	$2,450	$3,035	....	....	....	....	....	....	....	....	....	....	....	$2,255	$2,380	....	....	$1,870	....
Stand-pipe .....16x100 ft.	$3,200	....	....	....	....	$5,689	$3,325[1]	$3,600	$5,879	$4,495	*$3637[5]	$4,000	$4,775	....	....	....	$3,925	$4,625	....	....	$4,800	....
Total	$18,858	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	$23,000	$19,900

* Machine flange. ** Ordinary flange. [1] 10 x 16, 8½ x 12. [2] 10 x 16, 8 x 10. [3] 10 x 16, 9 x 12. [4] No foundation. [5] Wrought iron, $3,253. [6] Crane & Co. [7] Chapman or Eddy. [8] Including $117 extra for setting valves and hydrants.

TUNNEL.—Pittsburg, Pa.—The Pittsburg, Beltzhoover & Knoxville Ry. Co. is reported as receiving bids for the construction of its proposed tunnel, 3,000 ft. long. James M. Bailey, Pres.

CONDUITS.—Cincinnati, O.—Bids are asked until July 2 for constructing underground conduits for the fire department. Engr., J. A. Stewart, Johnston Bldg.; D. W. Shedd, Secy. Fire Trustees.

PUMPING PLANT.—Brooklyn, N. Y.—A press report from Washington, D. C., states that plans and specifications have been completed for a new pumping plant for the granite dry-dock at the navy yard in this city, estimated to cost about $40,000.

BREAKWATERS.—Block Island, R. I.—Bids are asked until June 29 for 20,200 tons of stone, 85,000 ft. of pile sheathing, and 100 piles required for extending and building breakwaters, as stated in our advertising columns. Edward P. Champlin, Clk.

PIER.—Charlotte, N. Y.—William M. Robinson, of Charlotte, has been granted authority by the Secretary of War to build a pier 700 ft. into Lake Ontario at Ontario Beach. The pier will be 14 ft. wide, and cost about $10,000, according to reports.

WHARF REPAIRS.—Port Royal, S. C.—Bids are asked until July 10 for repairing the main wharf and constructing and placing a crib at the naval station at this place. Address E. O. Matthews, Chief of Bureau of Yards and Docks, Washington, D. C.

DREDGING.—Philadelphia, Pa.—Plans are about completed for the dredging of the Delaware and Schuylkill River channels, for which the council has appropriated $225,000. It is stated that the principal work in the Delaware River will be the removal of ledges.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until July 2 for furnishing cement, brick, pipe,

CONTRACT PRICES.

SEWERS.—Plainfield, N. J.—The following bids were received June 19 for constructing an outfall sewer, as advertised in Engineering News; A. J. Gavett, Constr. Engr.; F. W. Farquhar, Consult. Engr.:

Quantities.	John Marsden, Utica, N. Y., $14,058.	C. T. Moore, Philadelphia, Pa., $14,850.	P. T. Plunkett, Jersey City, N. J., $16,712.	M. Honan & Sons, Chester, Pa., $19,404.	C. R. Walton, Trenton, N. J., $26,500.	M. McNamara & C. T. Bride, $20,348.
24-in. sewer:						
Under 8 ft. deep	885 ft.	$1.28	$1.89	$1.00	$1.51	$1.65	$2.00
8 to 10 " "	750 "	1.50	1.89	1.73	1.71	1.80	2.30
10 " 12 " "	835 "	1.50	1.89	1.85	1.91	2.65	3.00
12 " 14 " "	600 "	1.65	1.89	2.00	2.21	2.80	3.26
14 " 16 " "	690 "	1.90	1.89	2.20	2.50	3.50	3.60
16 " 18½" "	2,770 "	2.28	1.89	2.40	2.91	3.90	3.86
Manholes:						
Under 8 ft. deep	1...	30.00	30.00	30.00	33.00	30.00	29.00
8 to 10 " "	3...	32.00	30.00	35.00	37.00	32.00	33.00
10 " 12 " "	2...	35.00	30.00	40.00	43.00	35.00	38.00
12 " 14 " "	1...	36.00	35.00	40.00	49.00	45.00	43.00
14 " 16½" "	2...	40.00	35.00	40.00	59.00	50.00	48.00
16 " 18½" "	6...	45.00	35.00	45.00	67.00	60.00	50.00
Y-brchs. 24-in. pipe	79...	2.30	4.10	1.75	3.00	2.50	4.27
T-brchs, 24-in. pipe,	100...	2.30	4.10	1.75	2.57	2.50	4.27
Double 6x4-in. Y's.	100...	.50	.50	.75	.90	1.00	.75
*6-in. pipe,	400 ft.	.12	.34	.20	.19	.30	.25
4-in. underdrain..	100 "	.10	.28	.60	.13	.60	.30
6-in. " ..	100 "	.12	.34	.70	.23	.15	.25
12-in. " ..	100 "	.30	1.05	.80	.49	.40	.46
**Concrete	4,250 "	.20	.20	.40	.57	1.20	1.50

* In extension connections. ** Foundation and backing. *** Washington, D. C.

CAST IRON PIPE.—Washington, D. C.—The following bids were received June 20 for a supply of cast iron water pipe, as advertised in Engineering News:

Bidder.	20 in., ¾-in. thick.	11-16 in. thick.	12-in., 9-16 in. thick.	6-in., 7-16 in. thick.
R. D. Wood & Co.	$21.70[1]	$21.70[1]	$21.70[1]	$22.70[1]
	20.50[2]	20.50[2]	20.50[2]	21.50[2]
Chattanooga Pipe & Fdry Wks.	21.60	21.60	.....	.....
Warren Foundry & Machine Co.	23.20	23.20	23.20	23.20
M. J. Drummond, New York	22.00	22.00	21.40	21.40

[1] Cars. [2] Boat.

WOOD PAVING.—Stevens Point, Wis.—J. E. Rogers, Cy. Clk., writes us that the following bids were received June 10 for the construction of 8,000 sq. yds. of cedar block pavement, to be laid on a foundation of 2 ins. No. 1 hemlock plank upon 1 x 8-in. stringers, plank and stringers to be tarred, and 2,500 lin. ft. of stone curbing, excavating not included:

	Paving, per sq. yd.	Curbing, per lin. ft.
Jas. N. Fife, Oshkosh, Wis.	$0.81½	$0.44½
McGrath & Anderson, Green Bay, Wis.	.74½	.39
Wells, Reichert & Co, Appleton, Wis.	.68	.44
McCaul & Stevens, Chippewa Fls, Wis.	.82	.40
Frank Wheelock (awarded contract)	.68	.44

PUMPING ENGINE.—St. Paul, Minn.—John Caulfield, Secy. Comrs., writes us that the following bids were received June 12 for a 5,000,000-gallon pumping engine; duty, 90,000,000; lift, 37 ft.; pump to be used in the well plant:

E. P. Allis & Co., Milwaukee (awarded contract)	$7,500
Robinson & Cary Co., St. Paul	8,500
Deane Steam Pump Co., Holyoke, Mass.	10,770

SEWERS.—Ithaca, N. Y.—The following bids were

received by the sewer commission June 22 for constructing section 2 of the new system, contracts being awarded to Thos. Moore, the lowest bidder; bids for section 1, the outfall sewer, were rejected, and work will be readvertised; Ch. Engr., Henry N. Ogden; Asst. Engr., Kirk P. Crandall:

Quantities.			C. E. Cornell, Ithaca, N. Y., $38,076.	H. S. Eveline, Troy, N. Y., $32,360.	Thos. Moore, Buffalo, N. Y., $24,621.	J. McCloud, W'msport, Pa., $43,225.	Dodge & Mac-Gregor, Buffalo, $30,183.	Burns & Barks, Niagara Falls, $28,188.
6 to 8 ft.	7,075	ft.	$3,325	$2,547	$990	$4,457	$2,476	$2,618
8 " 14 "	8,820	"	6,527	8,732	2,381	9,526	4,851	6,791
14 " 18 "	1,780	"	2,884	3,115	1,424	4,895	2,670	2,108
Furnishing pipe:								
24 in.	1,400	ft.	3,098	2,394	3,520	3,326	2,834	2,429
70 Y's	271		479	280	498	498		164
20 in.	900	ft.	1,267	970	1,336	1,188	1,119	960
40 Y's	107		191	120	200	198		93
18 in.	320	ft.	326	245	320	288	277	237
12 Y's	24		43	24	46	45		21
16 in.	5,235	ft.	5,026	3,403	4,188	4,188	3,769	3,874
210 Y's	365		624	315	693	655		367
15 in.	2,960	ft.	2,398	1,569	1,776	2,072	1,924	1,598
120 Y's	176		318	156	348	336		156
12 in.	3,620	ft.	2,063	1,023	1,448	1,629	1,276	1,014
144 Y's	138		197	173	240	240		94
10 in.	2,115	ft.	994	418	634	740	587	444
84 Y's	56		92	84	101	102		42
Laying pipe:								
24 in.	1,700	ft.	3,098	2,394	3,520	3,326	2,834	2,429
20 "	900	"	198	89	89	267	40	26
18 "	320	"	64	29	26	86	10	38
16 "	5,235	"	576	340	314	785	262	12
15 "	2,960	"	326	192	148	444	148	188
12 "	3,620	"	326	181	109	362	127	119
10 "	2,115	"	169	106	63	211	63	59
Manholes:								
6 to 10 ft.	40		1,080	1,280	1,000	1,000	1,400	1,060
10 " 18 "	24		648	1,200	720	720	1,200	1,068
Iron	17,000	lbs.	1,190	425	680	425	340	425
Siphon, etc.			3,646	1,851	2,055	3,920	2,513	1,155

LAYING PAVING BRICK AND GRANITE BLOCKS.—Wilmington, Del.—Harvey J. Wiley, Secy. St. Dept., writes us that contracts were awarded last week as follows: To C. H. & H. C. Simmons, for laying vitrified brick, at 7 cts. per sq. yd. for sand joint finish; to Lynn & Phillips, for laying granite blocks, at 43 cts. per sq. yd. for pitch or hot tar and gravel joint finish; to Erby P. & Wm. Davis, for laying granite blocks, at 28¾ cts. for gravel joint finish; all being residents of this city.

METAL MARKET PRICES.

LEAD.—New York: 3.27 to 3.3 cts. Chicago: 3.1 to 3.2 cts. St. Louis: 3.07 to 3.1 cts.

FOUNDRY AND PIG IRON.—New York: $10.50 to $13. Pittsburg: $10.50 to $11.25. Chicago: $10.25 to $11.50.

TRACK MATERIAL.—New York: Angle bars, 1.1 to 1.25 cts.; spikes, 1.5 to 1.65 cts.; track bolts, 1.85 to 2 cts. with square, and 2 to 2.1 cts. with hexagon nuts. Chicago: angle bars, 1.25 to 1.35 cts.; spikes, 1.8 to 1.85 cts.; track bolts, 2 cts., with hexagon nuts.

RAILS.—New York: $24 at eastern mills and $24.75 at tidewater; old rails, $12.50 to $13 for iron, and $10.50 to $11 for steel; steel rails, fit for relaying, $15; light rails, $20 to $21; girder rails, $24. Pittsburg: $22 for standard sections of 45 lbs. and over; $23 for light sections; old rails, $12.50 for iron and $10 for steel. Chicago: $23 for standard sections; $25 for light sections; old rails, $13 to $14 for iron, and $8.50 to $12 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.3 to 1.5 cts.; channels, 1.35 to 1.5 cts.; angles, 1.2 to 1.35 cts.; tees, 1.4 to 1.6 cts.; universal mill plates, 1.3 to 1.35 cts.; steel plates, 1.2 to 1.3 cts. for tank, 1.35 to 1.45 cts. for shell, 1.5 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.5 cts. for locomotive firebox. Pittsburg: beams 1.3 to 1.7 cts.; channels, 1.3 to 1.7 cts.; angles, 1.2 to 1.25 cts.; tees, 1.35 to 1.4 cts.; universal mill plates, 1.25 to 1.3 cts; steel plates, 1.3 to 1.4 cts. for tank, 1.4 to 1.45 cts. for shell, 1.45 to 1.5 cts. for flange, 2 cts. for ordinary firebox, and 2 to 4 cts. for locomotive firebox. Chicago: beams, 1.55 to 1.6 cts.; channels, 1.55 to 1.6 cts.; angles, 1.45 to 1.5 cts.; tees, 1.65 to 1.7 cts.; universal plates, 1.55 to 1.6 cts.; steel plates, 1.55 to 1.6 cts. for tank, 1.75 to 2 cts. for flange, 2.1 to 4.5 cts. for firebox.

IRON AND STEEL.—The New York "Journal of Commerce" reports that American pig iron is selling very fairly in moderate-sized lots for prompt and near future delivery, but transactions on a large scale are few and far between, as consumers are disinclined to stock up ahead largely at present prices. Upon the whole, the market is firm, and iron for delivery during the next two months is offered with some reserve. Old material, car wheels excepted, is sparingly offered, since supplies are moderate in nearly all quarters. This, along with fair demand, keeps prices very firm, particularly for rails and wrought scrap. Buyers of steel rails are not at all numerous in this locality, and those who are negotiating do not appear anxious. The combination price for sections above 45 lbs. per yd. is kept at $24 at mill, and manufacturers affirm that no concessions, indirect or otherwise, are being made. Light sections sell at $24 to $26 at mill. Girder rails are in steady demand, and it is difficult to secure promise of delivery within ninety days on new orders. In other manufactured steel and iron a fair amount of business is passing, but there is not the snap to operations that was a prominent feature in some departments a short time ago. Prices are quite firm all along the line.

INDUSTRIAL NOTES.

BLANCHARD & MARSDEN, of Hazleton, Pa., have organized a company to contract for sinking artesian wells.

THE PENNSYLVANIA STEEL CO., of Steelton, Pa., has the contract for seven bridges on the Pittsburg & Eastern R. R.

THE BARBER ASPHALT PAVING CO., of New York, N. Y., will erect a mill, office and storehouse in Detroit, Mich., for its paving work in that city.

THE SMEDLEY MFG. CO., of Dubuque, Ia., is building a pumping engine of 3,000,000 gallons daily capacity for the Eighth St. pumping station of the water company.

THE LINDEN STEEL CO., of Pittsburg, Pa., will have receiver's certificates issued to the extent of $30,000, by permission of the court, and it is stated that this will enable the works to be kept in operation.

THE MICHIGAN PIPE CO., of Bay City, Mich., reports that it has a contract to supply the New England Telephone & Telegraph Construction Co. with all the creosoted wood conduit which it will lay this season.

THE WESTINGHOUSE MACHINE CO., of Pittsburg, Pa., has voted to increase its bonded debt $350,000 to pay for the construction of the new shops at East Pittsburg, Pa. Business is reported to be good.

THE MONMOUTH MINING & MFG. CO., of Monmouth, Ill., has been awarded the contract for furnishing the sewer pipe for the new sewerage system at Sterling, Ill. Geo. F. Miller & Co., Ottawa, Ill., are the contractors.

C. W. FISHER & CO., of Boston, Mass., state that they have been awarded the contract for the 1,600 tons of cast iron pipe for the new water-works at Yarmouth and Mechanic Falls, Me., now being constructed by W. H. Hayden, of Bath, Me.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn., has extended its main shop 126 ft., and is erecting a new forge shop 300 × 60 ft. Several new machine tools have been put in. The company has contracts for a large number of mill buildings, machine shops, boiler houses, etc.

THE BOSTON ORE MACHINERY CO., 186 Summer St., Boston, Mass., states that it has an order for 25 of its new rock and ore crushers for a mining company. It is also introducing a new concentrator. Geo. B. Thayer is the company's General Manager. We shall describe the new rock crusher shortly.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., states that it has received an order from the National Docks Ry., Jersey City, N. J., for six complete interlocking plants, with a total of 152 working levers. It has also been awarded a contract for a plant of 32 levers on the Brooklyn Elevated R. R., in Brooklyn, N. Y.

JAMES STEWART & CO., of St. Louis, Mo., contractors, report that they have a contract with the Gramercy Co. to build, at Gramercy, La., 45 miles from New Orleans, the largest sugar refinery in the United States, having a capacity of 25,000,000 lbs. per year. They have also contracted with the Indiana Distilling Co. to build its second large distillery at Terre Haute, Ind., which, it is said, will be the largest in the United States.

KELLY & ATKINSON, 1105 Security Building, Chicago, Ill., are completing the erection of a large coal dock of 400 tons capacity for the Ohio Coal Co., Duluth, Minn. J. W. Kelly is in charge of the work. They have recently taken down the three steel mills at Belleville, Ill., formerly owned by the Valley Steel Co., and re-erected them at Alexandria, Ind., where they become the property of, and are to be operated by, the Union Steel Co., of Alexandria, Ind.

THE MOORE MFG. CO., of Buffalo, N. Y., reports that this month it has leased sewer machines to James Connolley, of Cleveland, O., for use on the Wilson Ave. sewer; to J. H. Roche, of Chicago, for his sewer contract in Sheboygan, Wis., and to Clement & Co., of Niagara Falls, N. Y. This makes two machines in use by the last-named firm. The company has also received orders from Dwyer & Huntington, of Buffalo, N. Y., for two hoisting engines for use on their grade-crossing contract. The Moore sewer trench machine was described and illustrated in our issue of Dec. 6, 1894.

THE BUFFALO FORGE CO., of Buffalo, N. Y., reports that it is introducing large numbers of steel plate fans of special construction to be used for brick drying purposes, utilizing the heat from the burning kilns. It has large fans for such service in use at the yards of the May, Purrington & Bonner Brick Co., Weber-Labahan Brick Co., Jefferson Brick Co., B. F. Weber, and others, and has obtained patents upon this improved apparatus, and also upon the special arrangement and application for drawing heat from one kiln to another for cooling purposes. The Oakland Pressed Brick Co., of Zanesville, O., has an apparatus of the latter kind and proposes to use it also for drying.

THE BROWN HOISTING & CONVEYING MACHINE CO. and the ELWELL-PARKER ELECTRIC CO., with main offices and works at Cleveland, O., have opened a general Western office at 1528 Marquette Building, Chicago. F. G. Tallman, Manager of the Pittsburg offices of these companies, and late Manager at Pittsburg for the crane department of the Yale & Towne Mfg. Co., will also have charge of the Chicago office and will be assisted by Frank B. Ward, late resident engineer of the Pittsburg Testing Laboratory, and for several years head of the firm of Frank Ward & Co., inspecting and consulting engineers. The Brown Hoisting & Conveying Machine Co., in connection with its hoisting and conveying machinery and crane business, has recently purchased the crane business of the Yale & Towne Mfg. Co., as already noted in our columns. The Elwell-Parker Electric Co. of America, which is the American branch of the well-known English firm of the same name, is making a specialty of heavy electric machinery and large plants.

NEW COMPANIES.—Globe Steam Heater Co., North Wales, Pa.; $45,000, with $4,500 paid in; Treas., Frank M. Dampman, Philadelphia, Pa.; Director, Hosea K Kreibel, North Wales, Pa.

Union Boiler Tube Cleaner Co., Pittsburg, Pa.; $5,000; Treas., Wm. E. Frick, Pittsburg.

Erie Foundry Co., Rochester, N. Y.; $12,000; Frank H. Clement, J. Elwood McKelvey and R. J. McKelvey.

Standard Guard Rail Fastener Co., Lancaster, Pa.; $10,000, with $1,000 paid in; Treas., John Hertzler.

Arnold Automatic Fire Escape Co., Omaha, Neb.; $100,000; D. J. Arnold, E. D. Pratt and J. G. Cartelyon.

Liberty Building Co., Rochester, N. Y.; $40,000; Hiram W. Sibley, Brickson Perkins and J. Foster Warner.

Coffeyville Plumbing & Drilling Co., Coffeyville, Kan.; $1,000, with $500 paid in; M. A. E. Patton, J. H. Keith and Elmer Joyce.

Pennsylvania Subway Co., Camden, N. J.; $1,000,000, with $1,000 paid in; Daniel McCormick and Martin J. Grimes, of Philadelphia, Pa.; Emil J. Dodelin, of Camden, N. J.

Keystone Varnish Co., Long Island City, N. Y.; $36,000; Theodore T. Lines, of Flushing, N. Y.; Nelson V. Arnold, of Westfield, N. J., and Randall O. Walker, of Brooklyn, N. Y.

Gulf Coast Contract Co., New York, N. Y.; $2,500,000, with $50,000 paid in; W. E. Merritt, of Easton, Pa.; Erie T. Orr, of New York, N. Y., and P. S. Young, of Boston, Mass.

C. J. Field Co., New York, N. Y.; $4,000; electrical engineering; Cornelius J. Field, of Brooklyn, N. Y.; Frank Bourne, of Mount Vernon, N. Y.; John W. Gilmore, of New York, N. Y.

Central American Development Co., San Francisco, Cal.; $1,000,000, with $18,000 paid in; C. T. Thomas and A. Ballin, of San Francisco; F. A. Woodworth and M. Casin, of Santa Barbara.

Pacific Refining & Roofing Co., Grayson, Cal.; $100,000, all paid in; refining asphalt for roofing, paving, etc.; W. J. Watson and J. H. Hendy, of San Francisco; Aaron Schroyer, of Oakland, Cal.

PROPOSAL ADVERTISEMENTS LAST WEEK.

Engineering News of June 20 contained 112½ ins. of proposal advertisements, every advertisement published having been sent to this office by an official with an order for its insertion in our columns. The work thus advertised was as follows:

	Bids close.
Riprap stone, Tompkinsville, N. Y.	June 22
Furnishing fire-box boilers, Boston, Mass.	June 22
Asphalt or brick paving, W'msport, Pa.	June 25
Constructing 17¾ m. of the T., L. E. & P. Ry.	June 25
Metal work, Round Island L't Station, Mich.	June 26
Erection of Round Island Light Station.	June 26
Furnishing cast iron pipe, Brooklyn, N. Y.	June 26
Furnishing sewer materials, Brunswick, Me.	June 27
Constructing water-works, Monaca, Pa.	June 27
Constructing sewers, Brunswick, Me.	June 27
Boiler and stack, Asbury Park, N. J.	June 28
Stand-pipe and foundations, Maywood, Ill.	June 28
Pumping engine, Asbury Park, N. J.	June 28
Constructing 40 miles of the T., H. & B. Ry.	June 29
Constructing sewers, Grinnell, Ia.	July 1
Furnishing lead pipe, Syracuse, N. Y.	July 1
Constructing sewers, Winnetka, Ill.	July 1
Constructing sewer, Dolgeville, N. Y.	July 1
Constructing water-works, Memphis, Mo.	July 1
Constructing water-works, Elkhorn, Wis.	July 1
Water-works, Cornwall-on-Hudson, N. Y.	July 5
Water-works, Rockville Center, N. Y.	July 6
Constructing sewers, East Orange, N. J.	July 8
Macadamizing roads, Richmond County, N.Y.	July 8
Furnishing plate girders, Syracuse, N. Y.	July 8
Steel water tank, Cincinnati, O.	July 9
Constructing reservoir, New York, N. Y.	July 10
Street lighting, also for erecting an electric light plant, Knoxville, Tenn.	July 11
Brick paving (2 advts.), Waukegan, Ill.	July 15
Plans for art building, Philadelphia, Pa.	Oct. 1

RESULTS OF A TRIAL.

Sterling, Ill., June 17, 1895.

Engineering News Publishing Co.,
Tribune Building, New York City.

Gentlemen:

I enclose list of bids received June 13 for the West Broadway sewer. In this connection I beg leave to inform you that our city realized this time as never before the benefits of advertising its work in the Engineering News. We did not advertise for bids in any paper except the News, and had time for but one insertion in that, and yet I received 112 applications for specifications, and we received 17 bids, while twice that number of bidders were on the ground.

Yours truly,

J. F. Barrett, City Clerk.

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In this Issue: Nantasket Meeting AM. SOC. C. E.—The Responsibility for BOILER EXPLOSIONS.—New Brooklyn TERMINAL, Brooklyn Bridge Ry.

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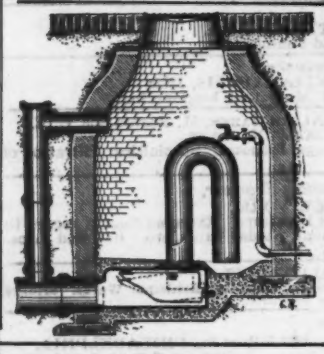

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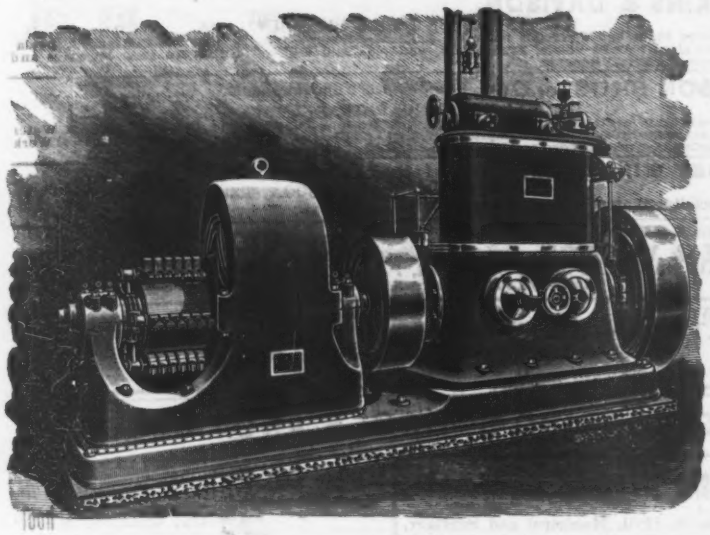

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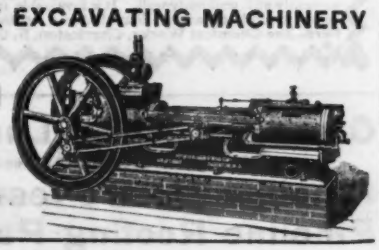

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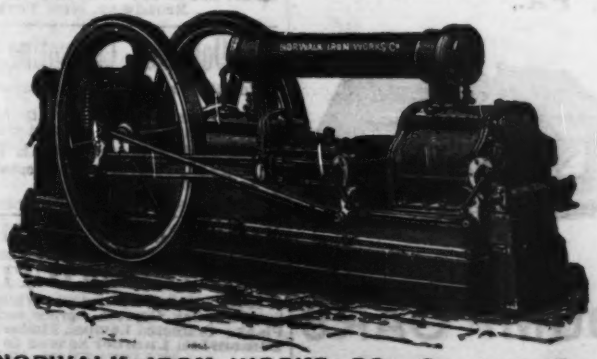

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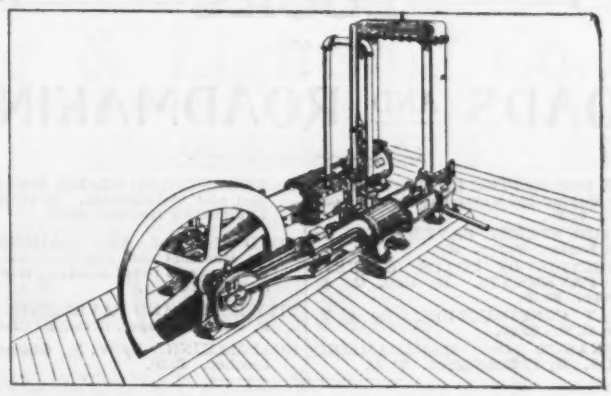

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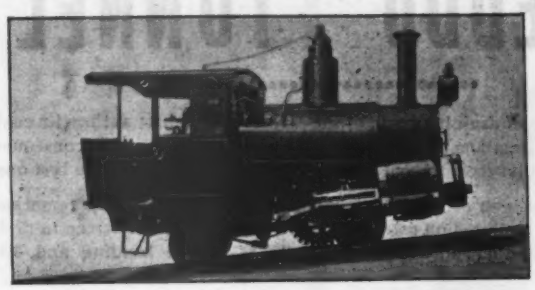

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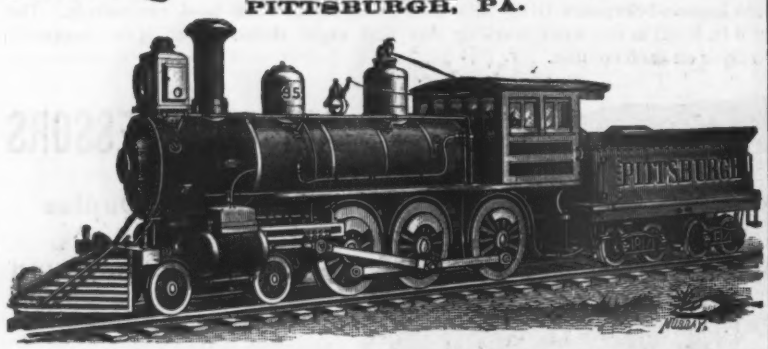

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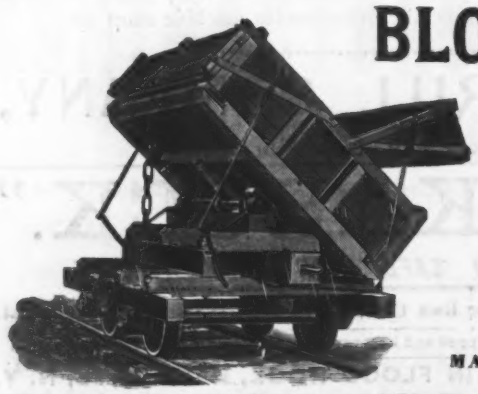

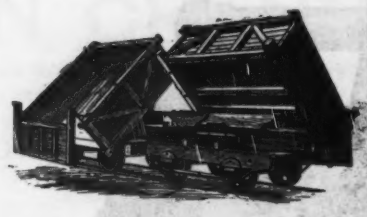

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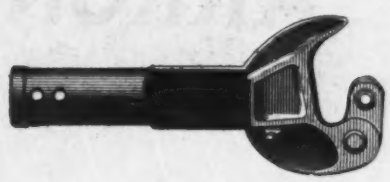

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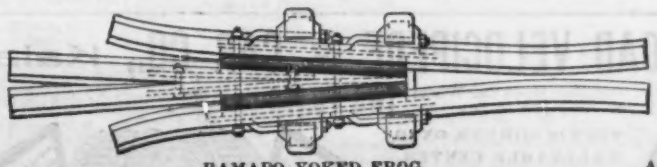

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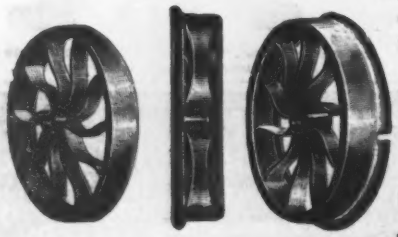

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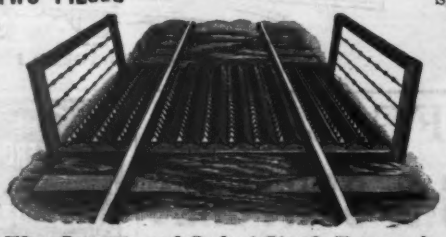

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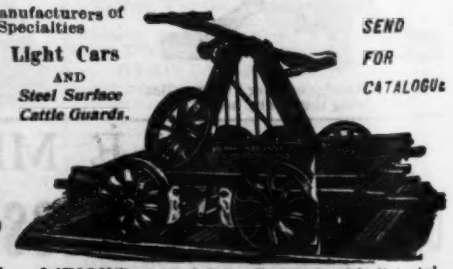

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Rand Drill Co., 23 Park Place, New York.

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Morris, Tasker & Co., Philadelphia
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Flenger & Henger Mfg. Co., St. Louis, Mo.
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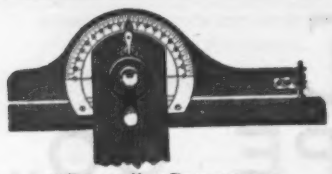

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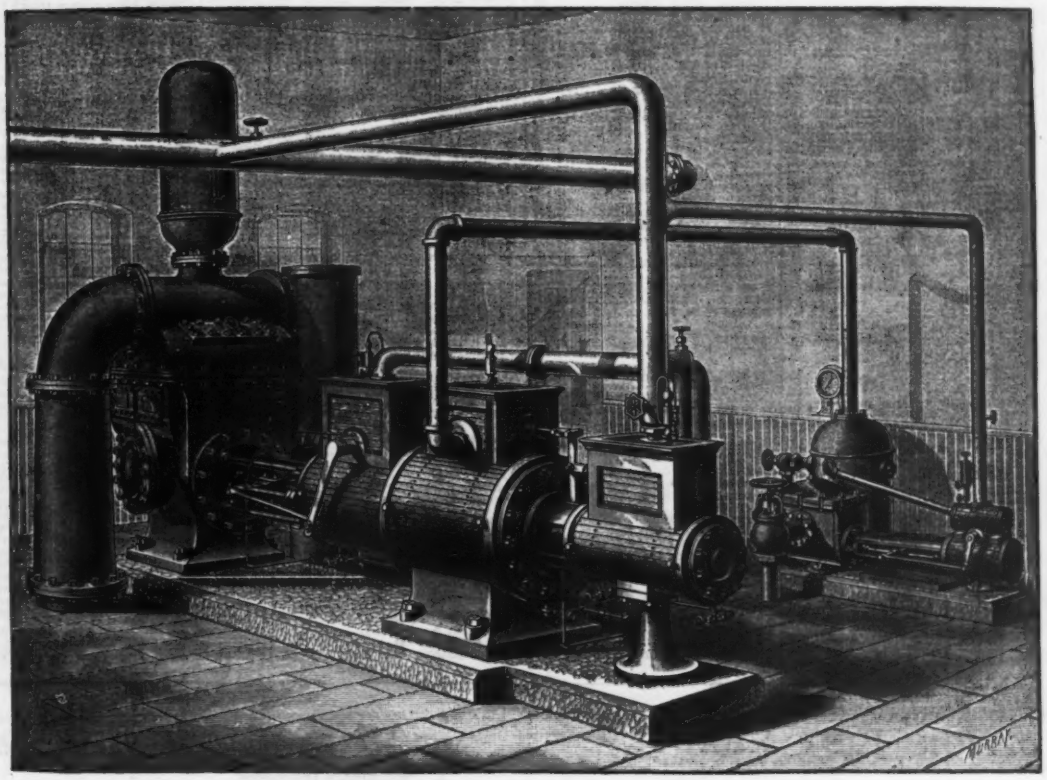

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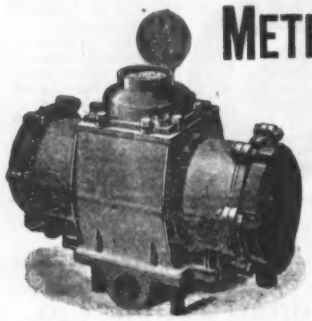

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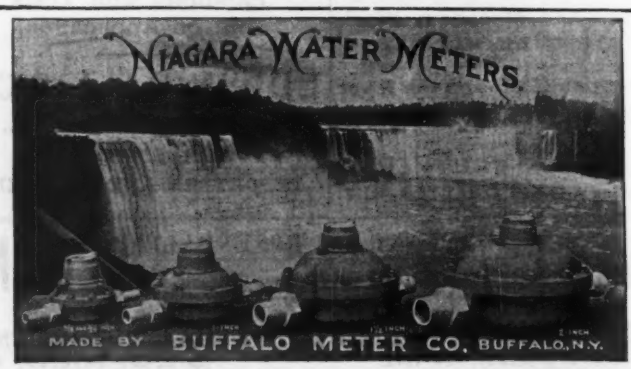

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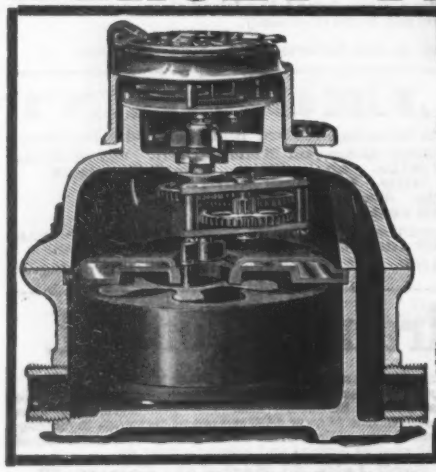

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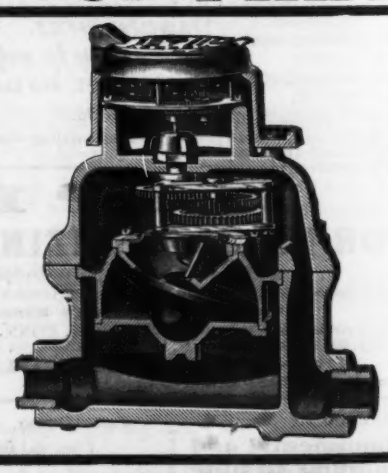

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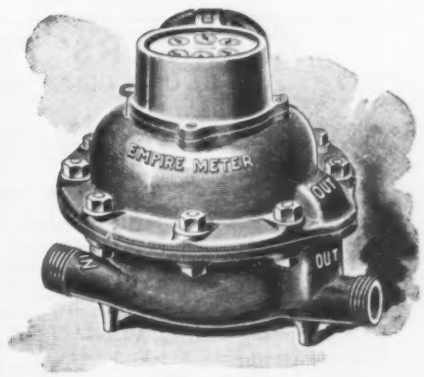

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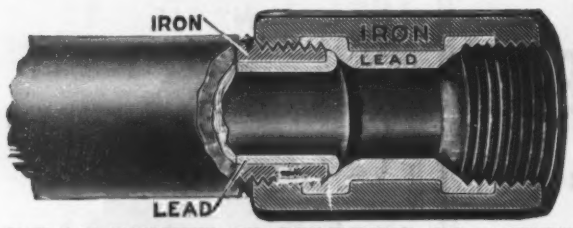

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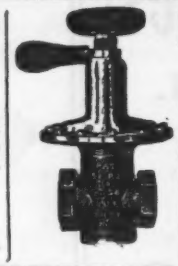

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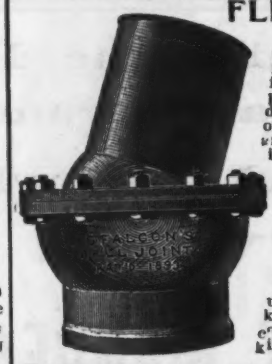

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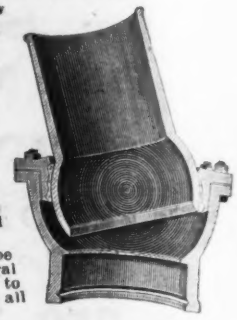

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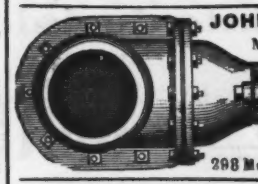

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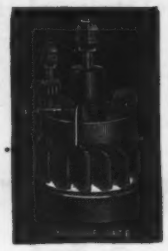

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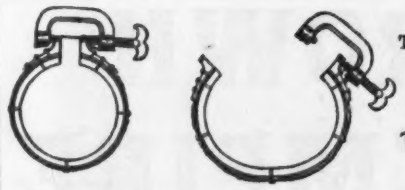

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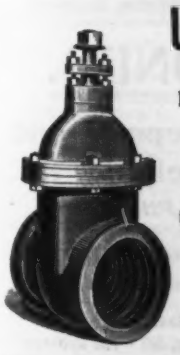

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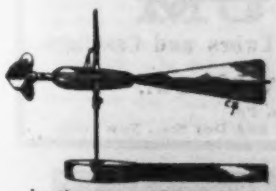

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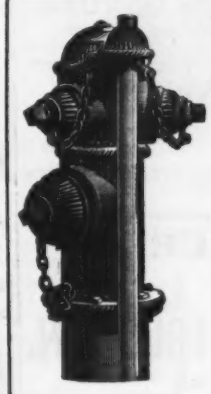

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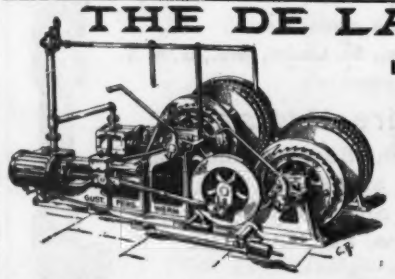

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SEWERS, GRINNELL, IOWA.

Sealed Proposals will be received at the office of the City Clerk of the City of Grinnell, Iowa, until 7 o'clock p.m., July 1, 1895:

For all material and labor for the construction of a Sanitary Sewerage System of about 9.5 miles upon the streets, alleys and other routes, in the City of Grinnell, Iowa, of approximately the following sizes of pipes:

1,150 ft.	.....	30	inch	sewer pipe
1,600 "	.....	24	"	"
1 328 "	.....	20	"	"
3,000 "	.....	18	"	"
2,720 "	.....	15	"	"
1,278 "	.....	12	"	"
12,956 "	.....	10	"	"
27.200 "	.....	8	"	"

Together with Manholes, Catch Basins, Flush Tanks, and all appurtenances, as shown by the plans, specifications, profiles and details therefor, which may be seen at the office of the City Clerk.

Each proposal must be made upon printed blanks furnished by the city and accompanied by a certified check of one thousand ($1,000) dollars, payable to the order of the city, as a guarantee that the contract, if awarded, will be entered into, and a satisfactory bond for fifteen thousand ($15,000) dollars furnished by the bidder, within ten days after receiving notice of award by mail to the address named in the bid.

Partial payments will be made on the estimates of the engineer in charge, on the Assessment Certificate plan, as provided by law.

Proposals must be inclosed in envelopes sealed and marked "Proposal for Sewers, Grinnell, Iowa."

Proposals to be considered July 1, 1895.

Contract to be completed before Nov. 1, 1895

The right to reject any or all bids is reserved.

J. F. WILSON, City Clerk.

H. H. ROBBINS,
R. G. COUTTS.
C. A. SWISHER, } Sewer Committee.

Grinnell, Iowa, June 6, 1895. 24-3t

RESERVOIR, NEW YORK, N. Y.

ACQUEDUCT COMMISSIONERS' OFFICE,
Room 209 Stewart Building,
No. 280 Broadway,
NEW YORK, June 15, 1895.

TO CONTRACTORS.

Bids or proposals for doing the work and furnishing the materials called for in the approved forms of contract now on file in the office of the Aqueduct Commissioners, for building the Jerome Park Reservoir, near Kingsbridge, in the Twenty-fourth Ward of the City of New York, will be received at this office until Wednesday, July 10, 1895, at 3 o'clock p m., and they will be publicly opened by the Aqueduct Commissioners as soon thereafter as possible, and the award of the contract for doing said work and furnishing said materials will be made by said Commissioners as soon thereafter as practicable.

Blank forms of said approved contract and the specifications thereof, and bids or proposals and proper envelopes for their enclosure, form of bonds, and all other information can be obtained at the above office of the Aqueduct Commissioners on application to the secretary

By order of the Aqueduct Commissioners.

JAMES C. DUANE,
EDWARD L. ALLEN, President.
Secretary. 25-3t

WATER-WORKS, CINCINNATI, O.

MT. AUBURN TANK.

Sealed proposals will be received at the office the Board of Administration until 12 o'clock noon of Tuesday, July 9, 1895, as follows:

For all material and the labor required in building, complete, one (1) steel water tank 40 feet in diameter and seventy (70) feet high, for the use of the Mt. Auburn service.

Proposals will be received for this tank exclusive of the masonry foundation.

Plans and specifications are on file at the office of the Superintendent of the Water Department, new City Hall, Cincinnati, O.

For information apply to the Superintendent and Engineer of the City Water-Works.

The Board reserves the right to reject any or all bids.

Bidders must indorse their names and address on the outside of the envelope containing their bid, also the indorsement, "Proposal for Steel Tank at Mt. Auburn."

Each bid to be accompanied by two disinterested sureties or a certified check in the amount of one thousand dollars ($1,000) for the acceptance of the contract if awarded.

By direction of the board.

AUGUST HERRMANN, President.
A. P. BUTTERFIELD, Clerk. 25-2t

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NOTICE TO CONTRACTORS.

Sealed proposals addressed to the Board of Water Commissioners and indorsed "Proposals for Water-Works," will be received until 3 p. m., Friday, July 5, 1895, and opened immediately thereafter, for the furnishing of all material and performing all the work necessary to construct complete a system of water-works for Cornwall-on-Hudson.

The work includes the furnishing of approximately:

900 tons cast iron pipe 14 in. to 4 in. diameter.
10 tons special castings, ordinary.
4 tons special castings, special.
35 valves.
30 valve boxes.
50 double nozzle hydrants.
2 triple nozzle hydrants.
An impounding reservoir of 56,000,000 capacity.
A masonry distributing reservoir.
Also the laying of eight miles of pipe.

Bids will be received for the above in whole or in part. The right is reserved to reject any or all bids. A certified check, three per cent. of the amount of the bid must accompany each proposal. Plans and specifications can be seen at the office of the Board at Cornwall and plans can also be seen and specifications secured at the office of the engineer, 137 Broadway, New York, on or after June 26, 1895.

CARLOS H. STONE, President,
SAMUEL CALL,
HENRY N. CLARK,
CHAS. A. HEDGES,
WILLIAM A. SEAMEN.
Board of Water Commissioners
ALEXANDER POTTER,
137 Broadway, New York, Chief Engineer.
CHAS. H. WOOD
Clerk. 24-4t

BIDS WANTED FOR LIGHTING THE CITY OF KNOXVILLE, TENN.

Sealed bids will be received by the Board of Public Works at their office in Knoxville, Tenn., until July 11, 1895, at 2 o'clock p. m., for lighting the city with electricity or gas. For 200 arc lights 2,000-candle power each, all night service; or 800 to 1,000 gas lights of 18 to 20 candle power. Either contract to run for the term of five or ten years. All bids must be based upon the form of a contract, which may be had upon application.

Also bids will be received for the erection of an electric light plant to be paid for in yearly installments in five or ten years, the city to take charge of and operate the same within thirty days after completion. Certified check for $1,000 must accompany each bid.

The right is reserved to reject any and all bids or to let the contract to the most satisfactory bidder.

Specifications for erection of plant will be furnished upon application to

REPS JONES,
25-3t. Chairman Board of Public Works.

BRICK PAVING, LANSING, MICH.

Sealed proposals will be received by the Board of Public Works until Saturday, July 6, 1895, at 2:00 p. m., local time, for paving Michigan ave. with brick. Approximate quantities:

17,013 square yards brick and concrete.
8,609 lineal feet curbing.
3,910 " " drain pipe.
7,400 cubic yards excavation.

All bids to be addressed to Chas. S. Loomis, City Clerk, and accompanied by a certified check for $1,000. Plans and specifications now on file in the office of J. C. Davis, City Engineer.

Office, Board of Public Works,
Lansing, Michigan.

E. O. SELLERS,
26-2t Supt.

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STAND-PIPE, MAYWOOD, ILL.

Sealed proposals will be received by the Village Clerk of the Village of Maywood, Ill. or furnishing all labor and materials necessary for the construction of a stand-pipe and foundations according to plans and specifications prepared by Hill & Enricht, civil engineers, 1413-1417 Chamber of Commerce Bldg., Chicago, until 8 p. m., June 28th, 1895, at the village hall. Plans and specifications may be seen at the office of the engineers and at the Village Clerk's Office, Maywood, Ill. A certified check of $500, made payable to the Treasurer of the Village of Maywood, will be required with each bid, and the successful bidder will be required to enter into a contract with the Village of Maywood within five days after notification from the Village Board, and furnish a bond of $2,500, with securities satisfactory to the Village Board. Proposals must be made on blanks furnished by the Village Clerk or the Engineers.

SAM'L H. DONALDSON, JR.,
25-2t Village Clerk.

WATER TUBE BOILER AND STACK, ASBURY PARK, N. J.

PROPOSALS WANTED.

Sealed proposals addressed to the undersigned will be received until 12 o'clock m. June 28, 1895, at the office of the Water Commissioners of Asbury Park, N.J., for a 200 H.P. Water Tube Boiler and Stack to be delivered and erected complete at the main pumping station, Asbury Park, N. J., stack to be double the capacity of the boiler, and to be of best quality of iron, and of sufficient height to ensure a good natural draught. Bidders to state the shortest possible time in which they can do the work. The Water Commissioners reserve the right to reject any or all bids, or to accept any that they may deem most advantageous.

GEORGE W. TREAT,
JOHN L. COFFIN,
Water Commissioners.
ASBURY PARK, N. J., June 14, 1895. 25-2t

For Other Proposals See Page XXII.

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Electric Railway and Light Pipe Poles a Specialty.

NOTICE TO ARCHITECTS.

Office of the Commissioners of Fairmount Park City Hall, Rooms 127-129.
PHILADELPHIA, April 10, 1895.

Plans and specifications will be received by the Commissioners of Fairmount Park, until 12 m., Oct. 1, 1895, for an art building to be erected in Fairmount Park.

The Commissioners of Fairmount Park will award the following prizes for the various successful plans, namely:

1st Prize—Six Thousand Dollars ($6,000) for the plans and specifications of the building that shall be adopted.
2d Prize—Three Thousand Dollars ($3,000).
3d Prize—Two Thousand Dollars ($2,000).
4th Prize—One Thousand Dollars ($1,000).

Plans and specifications must be complete in all respects, and must comply with the general requirements and specifications that may be obtained by application to the undersigned.

Plans and specifications for which prizes are awarded will become the absolute property of the Commissioners of Fairmount Park.

RUSSELL THAYER,
Chief Engineer and Superintendent
21-6t Fairmount Park.

SEWERS, EAST ORANGE, N. J.

Clerk's office of the Township of East Orange.

Proposals to build sewers in the streets of East Orange, N. J., named below, will be received by the Township Committee of said township.

In Springdale avenue, from Midland avenue easterly about 350 feet, of 8-inch sewer with one flush tank.

In Central avenue, from South Arlington avenue, easterly about 650 feet, of 8-in. sewer with one manhole and one flush tank.

In Central avenue, from Halsted street westerly to Cambridge street, and southerly through Cambridge street about 428 feet of 10-inch sewer, and about 900 feet of 8-in. sewer, with four manholes and one flush tank.

Bidders must name separate amounts for each sewer.

Plans and specifications may be seen at the office of Wm. H. V. Reimer, Street and Sewer Commissioner, Township Building, Main street, East Orange, N. J.

Proposals must be endorsed, "Proposals to build sewer," and addressed to and delivered to Stephen M. Long, Township Clerk, not later than Monday evening, July 8, 1895, at 8 o'clock.

The committee reserve the right to accept or reject any or all bids as they may deem for the best interests of the township.

STEPHEN M. LONG,
Township Clerk.
Dated, East Orange, N. J., June 17, 1895.
25-3t

WANTS.

Rates under the heads "Situations Wanted," "Situations Open," or "Miscellaneous," 2 cents per word per insertion for one or two times; for 3 times or more 1¼ cents per word per insertion; each number, whether of one or more figures, counted as one word. Payment invariably in advance; no "till forbia" cards allowed; copy of paper containing card, 15 cents additional.

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CIVIL ENGINEER, 12 years experience in location and construction of railways, would like position on maintenance of way, division engineer or assistant. Address H. H., P. O. box 1,117, New York city. 20-4t. e.o.w.

CIVIL ENGINEER, age 32, with considerable experience on all kinds of construction, especially on railroad work, wants position where there is chance of permanency, with railroad or construction company. Address M. C. C., Engineering News. 21-4t. e. o. w.

CITY ENGINEERS or others requiring assistant experienced in water-works, sewers, city surveys and drafting, address "ENGINEER," Box 42, Station D., Pittsburg, Pa. 22-6t

TROY GRADUATE—Four years' experience in masonry construction, railroad and general engineering work—desires position. Address "TROY," Engineering News. 21-7t

WANTED — Position as assistant engineer, transitman, leveler, or rodman, by '94 graduate of University of Alabama; pursuing past-graduate course; have served two years as instructor of field-work; references. N. A. Y., Engineering News. 24-3t

WANTED—Position as draftsman in structural iron or bridge works, by graduate of a technical school. Best of references. Salary moderate. Address "COURAGEOUS," care of Engineering News. 24-3t

TOPOGRAPHER.—Place wanted by a first-class experienced topographer on railway or other work. Address E. W. HESS, Box 702, Hazleton, Pa. 24-3t

BUILDERS, CONTRACTORS, Foreman, experienced, reliable, sober, understands plans; quantities; contracting; set out work; order materials on jobs; manage men. THOMAS FARRELL, Stephensburgh, N. J. 25-3t

WANTED—Position by technical graduate, with five years' experience on construction. Good instrument man. Will take position as timekeeper for contractor or construction company. Considerable experience in latter position. New York or vicinity preferred. "TRANSIT," Engineering News. 25-2t

EXPERIENCED MASONRY AND TIE INSPECTOR wants position. Also good leveler, rodman, etc. First class references. W. H. CHRISTIE, Van Etten, Chemung Co., N Y. 25-3t

YOUNG MAN, age 26, with four years' experience, desires position as assistant (transit or levelman). "PRACTICAL," care of Engineering News. 26-4t

'95, TROY, wants situation on construction or maintenance of water-works. Water analyst. Address "BACTERIA," Engineering News. 26 3t

DRAFTSMAN of four years' experience in detailing bridge and structural work, desires position with bridge company, contractor or architect for steel buildings. Address "BEAM," care of Engineering News. 26-3t

RAILROAD CLERICAL. Position desired by young man, with three years' experience on construction, two years as chief clerk maintenance of way department; one year in transportation, auditing and car service departments. References. Address "CLERICAL," care carrier 75, Louisville, Ky. 26-1t

WANTED—Position by young man, accurate reliable and steady; good draftsman; experienced in engineering, maintenance and superintending of water-works. Address "H. W," care of Engineering News. 26-2t

CIVIL ENGINEER, experienced in water power construction, water-works, sewers, docks, dry docks, foundations and city work, desires position with corporation, town or construction company; has instruments. Address, "W. H." Engineering News. 26-3t.

YOUNG MAN, 19, desires position to learn engineering; one year's experience. Best reference from former employer. "W. N.," care Engineering News. 26-3t

WANTED—POSITION with a manufacturing concern, bank or city water company. Have experience as secretary and treasurer, correspondent and expert accountant. Unexceptionable references. Address "SECRETARY," Box 158, Radford, Va. 26-1t

WANTED—Position as locating or division engineer. Ten years' experience on railroad, bridge and water-works construction. Best references. F. S. T., care Engineering News. 25-3t

A CIVIL ENGINEER, graduate, with six years' experience on sewer work and general engineering practice, is open for engagement. Address C. U. E., care Engineering News. 25-2t

"'94" UNIVERSITY OF PENNSYLVANIA Graduate—Civil engineer desires a position; accept anything in line of profession. Address J, 388 Bullitt Building, Philadelphia. 24-6t

SITUATIONS OPEN

For rates see head of first column.
Engineering News cannot be responsible for what is stated in advertisements under this head. Applicants must themselves investigate the responsibility of the advertisers.

HEALTH INSPECTOR.—By a Board of Health for a town of 12,000 inhabitants within 15 miles of New York. Practical knowledge of sanitary engineering, including plumbing, required. Permanent position. State experience, education, age, salary expected. Address M. N. B., 104 Tribune Building, New York. 1t

AN EXAMINATION FOR CHIEF OF THE Bureau of Highways of the City of Philadelphia will be held in that city on Monday, July 1st, 1895. The examiners are Justus C. Strawbridge, Jno. H. Converse and Edgar Marburg, C. E. Applicants will receive the necessary blanks for application by applying to the Director of Public Works, Philadelphia. 26-1t

SITUATIONS OPEN FOR SEVERAL bridge draftsmen of experience. Applicants should state nature of experience, salary expected and earliest date on which they can report for work. PENNA. STEEL CO., B. & C. Dept., Steelton, Pa. 26-2t

WANTED—FOREMAN ON RAILROAD grading, construction on Montauk Extension R. R. Co. Experience and sobriety required. Call or address F. A. MOLITOR, Amagansett, Long Island. 26-1t

WANTED—Foreman Boilerman; must furnish best of reference and give full particulars. Address C. C. C., P. O. Box 2,132, New York. 26-1t

MISCELLANEOUS.

For rates see head of first column.

WILL PAY 15 cents each for copies of Engineering News of Jan. 3, 10 and March 7 (Nos. 1, 2 and 10) of this year 1895, received in good order at this office. Address B. P. F., care of Engineering News.

INDEXES to Vols. XXIII., XXIV., XXVI. and XXVII. wanted. Will give 25 cents apiece for perfect copies. Address "F. W.," care of Engineering News.

PARTNER WITH CAPITAL, to join advertiser in starting an enterprise, "building concrete," monolithic bridges, fireproof dwellings, warehouses. Address MONOLITHIC CONSTRUCTOR, Stephensburgh, N. J. 25-3t

CAMERA WANTED—Plate 6 × 8. Address, with full particulars, G. W. P., care of Engineering News. 26-1t

WILL PAY 25 cents each for copies of Engineering News of May 3, 1890, and January 24, 1891. Address C. A. JUDSON, Sandusky, O. 26-3t

DIPPER DREDGE WANTED—One ¾ to 1¼ yard second-hand dipper dredge. Give full description, price and present location. CHRISTIE & LOWE, 512 New York Life Building, Chicago, Ill. 26-3t

FOR SALE.

"Undisplayed" cards (type like that under "Situations Wanted") will be inserted under this head at the rate of 2 cents per word per insertion for one or more times; the minimum price being $1.00 per insertion. Each number is reckoned as one word. Payment must be sent with order invariably in advance, and no "till forbid" advertisements will be allowed. Special contracts will be made for advertising by the year and for "display" cards.

FOR SALE—20 THACHER AIR-DUMP cars.—These cars were used for one month by John Y. McKane on Long Island, and are in perfect condition. They will be sold at one-half their original cost and purchaser will be allowed one month's trial. Standard gage M. C. B. Vertical plane couplers. For further particulars apply to BLOOMSBURG CAR CO., Bloomsburg, Penna. 11-tf

FOR SALE.

Buff & Berger transit, nearly new, excellent order; only used one month; gradienter screw, stadia wires, full vertical circle, vernier shades, graduations on silver; all attachments. Was made to order and cost $250. Price $150. Address B. B. TRANSIT, care Engineering News. 26-2t

BRIGHTLY TRANSIT,

Absolutely new. A first-class modern instrument, complete with box, tripod, etc. For sale at a very low price. Can be examined at this office. For particulars, address
ENGINEERING NEWS PUBLISHING CO.,
23- Tribune Building, New York.

CHEAP PUMPS.

Nos. 6 and 12 Centrifugal Pumps (Baldwinsville), with Engines attached, on skids.
No. 6 New Pulsometer.
Three and Five Woodward Fly-wheel, and lots of other Cheap Machinery.
MASLINS' Contractors' Pumps, all sizes, new. Reduced prices. Exchanging lists free.
MASLINS,
163-167 First Street, Jersey City.

FOR SALE.

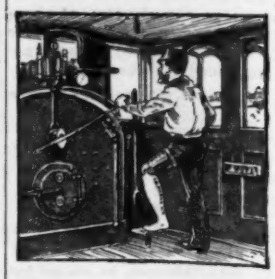
3 Steam Shovels.
7 Locomotives.
27 Cars.
11 Hoisting Engines.
27 Steam and Centrifugal Pumps.
Plows, Scrapers, Tubs and Derricks.
Complete Contractor's Outfits on hand.
THOMAS CARLIN'S SONS,
Allegheny, Pa.

Electric Motor for Sale.

A practically new 5 HP. Waddell-Entz Slow Speed Motor (in use only about four months) for sale at a low price.
Can be seen at any time on application at this office. Address "MOTOR,"
Care of Engineering News,
Tribune Building, New York.

ARTIFICIAL LEGS AND ARMS
WITH RUBBER FEET AND HANDS.

It is not unusual to see an engineer with hand on the throttle, or a conductor, brakeman, fireman, carpenter, mason, miner, in fact men of every vocation, wearing one or two artificial legs with rubber feet, Marks' Patents, and performing as much labor as men in possession of all their natural members.



Over 10,000 artificial limbs of Marks' patents in use. Purchased by the U. S. and many foreign governments. One-half of the limbs furnished by us are made from measurements without our seeing the wearers. Fit guaranteed. A treatise of 400 pages, with 300 illustrations and a formula for measuring sent free.

ADDRESS
A. A. MARKS 701 Broadway, New York.

FOR SALE OR RENT.

A Souther Steam Shovel, in first-class working order, nearly new, 1¾ cu. yds. dipper.
E. A. HERMANN,
2503 Lafayette Ave., St. Louis, Mo.

Receiver.

INDICATING and RECORDING GAUGES
(Electrical or Mechanical.)
Any Distance or Direct Acting. For Water, Tides, Sewerage, Gas, Gas Holders, Mains, Reservoirs, Tanks, Standpipes, Water Pipes, Kilns, Pressure, Temperature, Etc., Etc.
Height of Water in Standpipes. . . . . By Pressure Below the Frost Line.
Manufactured by F. J. DIBBLE, Peabody, Mass.

Transmitter.

NATIONAL ELASTIC NUT CO.
Foot of Russell Ave., Milwaukee, Wis.
MAKE Track Bolts fitted with Elastic Nuts. They never work loose, require no washer. Also Hot-pressed Nuts. All kinds of Bolts, Washers, Rivets, etc.

BRIDGE ENGINEERING

Mechanics; Mechanical Drawing; Electricity; Architecture; Architectural Drawing and Designing; Masonry; Carpentry and Joinery; Ornamental and Structural Iron Work; Steam Engineering (Stationary, Locomotive or Marine); Railroad Engineering; Municipal Engineering; Plumbing and Heating; Coal and Metal Mining; Prospecting, and the English Branches. Students make rapid progress in learning to Draw and Letter. Specially prepared Instruction and Question Papers, Condensed, Simplified. Send for Free Circular, stating the subject you wish to study, to
THE INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa.

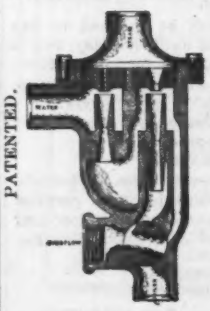
TAUGHT BY MAIL THOROUGH PRACTICAL

MINING, CRANE, BLOCK AND STEEL CHAINS.

IRON CITY CHAIN WORKS,
JAS. McKAY & CO., PITTSBURG, PA.
MANUFACTURERS OF
HIGH GRADE TESTED CHAINS.
All chain proved on a Tinius Olsen & Co.'s Hydraulic Testing Machine before shipping. Write for Prices.

SIMPLICITY, EFFICIENCY, ECONOMY

The Young Gravity Lock Nut.
The Brownley Injector.



PATENTED.

TROLLEY POLES and BRACKETS
All Railway Supplies.
For Information Address
THE YOUNG LOCK NUT CO.
150 Broadway NewYork City

Reliable Engineers,

Instrument Men and Draftsmen, furnished promptly through the ENGINEERING EMPLOYMENT BUREAU, Syracuse, N. Y.

No Charge to Employers.

SECOND-HAND RAILS FOR SALE.

3,000 Tons original 65-lb. T steel; 1,500 Tons original 60-lb. T steel; 1,200 Tons original 56-lb. T steel; 700 Tons original 50-lb. T steel; 1,400 Tons original 40-lb. T steel; 300 Tons 35-lb. T steel; 3,700 Tons 30-lb. T steel; 600 Tons 30-lb. T iron; 400 Tons 20-lb. T steel; 400 Tons 25-lb. T steel; 150 Tons 16 lb. T steel.

All sizes of Street Girder and Tram Rails.

All above I have positively for sale, and selected, and but little worn. In lots to suit buyers. Will purchase any size relayers.

JOSEPH JEWKES,
Railway Equipment, Pittsburg, Pa.

RAILS FOR RELAYING

CHEAP!

Immediate Delivery.

5,000 Tons 56, 60, 65 lb. Steel Relayers.
2,000 " 35-lb. Iron Relayers.

JOS. JOSEPH BROS., - Cincinnati, O.
Chicago Office, 1637 The Monadnock.

STEEL T RAILS!

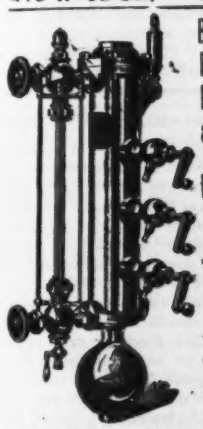
. . WE HAVE . .

950 tons selected second-hand 30-lb. Steel T Rails for sale; well located for shipment to points South.

—AND—

375 tons of 25's in West Virginia for early August delivery.

ROBINSON & ORR,
419 Wood St., Pittsburg, Pa.



Boilers Last Longer Fuel Goes Further, Repairs are Less and Life is Safer.

WHERE

RELIANCE SAFETY WATER COLUMNS ARE USED.

They should be included in all boiler specifications in the interest alike of economy and safety

Write for Catalogue.

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Sent on Trial Subject to Satisfaction.

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69 to 89 East Prospect St. Cleveland O.

THE UNITED STATES *Public Works*

Containing a Summary of the

Methods of Construction and Character of Materials and Plant

Used in the Public Works under the charge of the War and Treasury Departments, and of the Commissioners of the District of Columbia, including works of River and Harbor Improvement, Buildings at Posts of the United States Army, Lighthouses, Public Buildings, Life-Saving Stations, and Works of Municipal Engineering of Washington, D. C.; also of the Laws, Regulations and Forms Prescribed for the Conduct of such Works; and a Directory of the United States Agents in charge of these Works, and of Contractors for them; also of Manufacturers of and Dealers in Machinery, Materials and Miscellaneous Supplies Used in the Construction of the Works.

Published as a Book of Reference for all Persons Interested in the Public Works, and for Engineers and Contractors in general.

—BY—

CAPTAIN W. M. BLACK,
Of the Corps of Engineers of the United States Army, Member of the American Society of Civil Engineers.

Illustrated by over Forty Photogravures and Working Drawings.

Oblong, 4to, Cloth, $5.00.

JOHN WILEY & SONS,
NEW YORK.

SWARTHMORE COLLEGE,
SWARTHMORE, PA. Under care of Friends. Opens 9th month 17th, 1895. Full College Courses for young men and young women, leading to Classical, Engineering, Scientific and Literary degrees. Machine shops, laboratories and libraries. For Catalogue and particulars, address
CHARLES DeGARMO, Ph. D., President.

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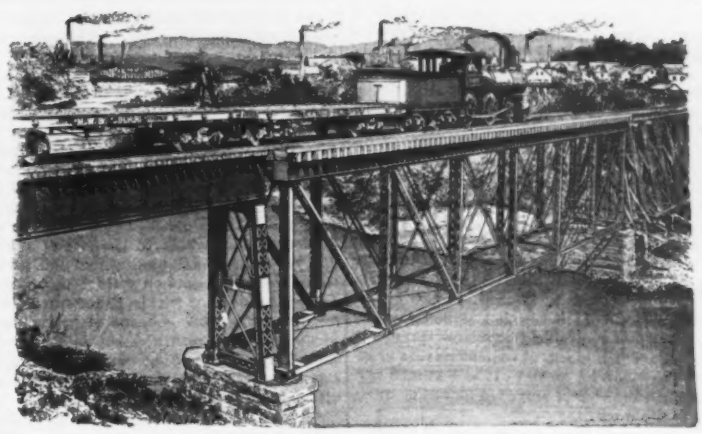
EASTON, PA.

Thoroughly equipped technical courses in Civil, Mining and Electrical Engineering and Chemistry.

For catalogues address
THE REGISTRAR.

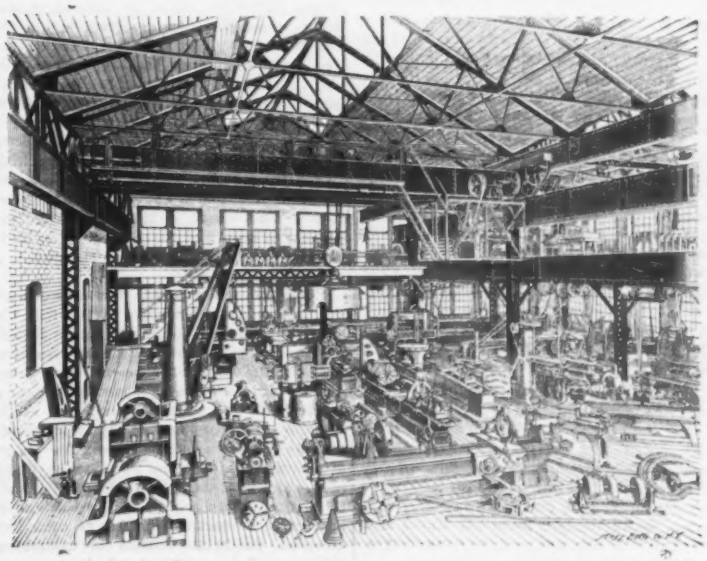
CHAS. M. JARVIS, Pres't and Chief Engineer. BURR K. FIELD, Vice-Pres't.
GEO. H. SAGE, Secretary. F. L. WILCOX, Treasurer.

THE BERLIN IRON BRIDGE CO.



RAILROAD BRIDGE AT WATERBURY, CONN.

The above illustration is taken direct from a photograph of an Iron Truss and Plate Girder Bridge designed and built by us to carry the tracks of the M. W. & C. R. R. R. over the Naugatuck River, at Waterbury, Conn.



MACHINE SHOP FOR THE BRIDGEPORT MACHINE TOOL CO., AT BRIDGEPORT, CONN.

The above illustration is taken direct from a photograph, and shows the interior of a Machine Shop designed and built by us for The Bridgeport Machine Tool Co., at Bridgeport, Conn. The building consists of two parts, each 40 ft. in width; that shown in the immediate foreground being one story high for erecting room, while that portion of the building shown on the right is two stories high—light work being done on the second floor.

Engineers, Architects and Builders of Iron and Steel Structures,

Office and Works: EAST BERLIN, CONN.

City Roads and Pavements.

By WILLIAM PIERSON JUDSON, M. Am. Soc. C. E., M. Inst. C. E.

Octavo. Flexible boards, 75 Cents. Cloth, $1.00.

From the Journal of the Association of Engineering Societies, Jan., 1895:

"While this work is prepared with special reference to the needs of the City of Oswego, it is believed that it will find application in many other cities in this country. . . . The work is very handsomely got up, and is profusely illustrated with photographs and with colored lithographs of the different form of construction. . . ."

From the Engineering Magazine, March, 1895:

"Although a great many books have been written upon the subject of pavements and road maintenance, this little book will have a place among the literature of road-making from the fact that it treats of roads specially adapted to towns of about the size of Oswego,—that is to say, containing about 25,000 inhabitants. It discusses the various methods which may and will be proposed for such towns, and the reasons why some are to be avoided and some are to be accepted and used. . . . The whole discussion is based upon general reports and results culled from statistics of 75 cities, together with the recently published floating literature upon the subject, written by experienced engineers and published in the technical journals. The book cannot fail to be of value to many municipal engineers and bodies of municipal officials

The above work should, of course, be owned by every City Engineer. It will also prove of great interest and value to

Municipal Officials

who are interested in road and street construction.

MACADAMIZING.

OFFICE OF THE ENGINEER OF COUNTY ROADS, Richmond County, N. Y.
HENRY P. MORRISON, Engineer,
P. O. Box 582,
STAPLETON, S. I., June 11, 1895.

Sealed bids or estimates will be received by the Board of Supervisors of Richmond County, N. Y., at the Village Hall, Stapleton, Staten Island, until July 8, 1895, at 3 o'clock p. m., for regulating, grading and constructing macadam pavement, and renewing the present macadam pavement, on certain hereinbelow mentioned county roads, in accordance with specifications, plans and profiles on file in this office.

8. Fresh Kills Road, in the town of Westfield, from Main street, Tottenville, to station 190-00 at Rossville, including Washington street, from Main street to Bentley street; estimated quantities, 35,000 sq. yds. of macadam pavement; 19,000 cu. yds. of excavation; 135 lin. ft. of 12-in. culvert pipe; 155 lin. ft. of 15-in. culvert pipe; 45 lin. ft. of 20 in. culvert pipe; 45 lin. ft. of 24-in. culvert pipe; 5 cu. yds. of dry rubble masonry; 5 cu. yds of cement rubble masonry; 800 lin. ft. of 4-in. tile drain; price per 1,000 for taking down and rebuilding brick masonry; price per lineal foot for pointing up brick culverts; price per lineal foot for relaying old pipe culverts; number of days bid for the completion of the work.

9. Richmond Road, in the town of Middletown, from the easterly side of Bay street to crosswalk on the easterly side of Court street; estimated quantities, 4,795 sq. yds. of macadam renewals; 1,200 cu. yds. of excavation; 275 sq. ft. of 3-in. flagging; 950 sq. ft. of new bridge stone; 240 sq. ft. of old bridge stone relaid; 10 sq. yds. of new specification block pavement; 5 sq. yds. of old block pavement relaid; price per lineal foot for 8, 10, 12, 15 and 20-inch culvert pipe; number of days bid for the completion of the work.

10. Richmond Road, in the town of Middletown, from station 42-50, at Broad street, to the northerly line of Vanderbilt avenue; estimated quantities, 5,250 sq. yds. of macadam pavement; taking up and relaying 850 sq. yds. of block pavement; 1,775 cu. yds. of excavation; 40 lin. ft. of 12-in. culvert pipe; 85 lin. ft. of 20-in. culvert pipe; 45 lin. ft. of 24-in. culvert pipe; 70 lin. ft. of 10-in. iron culvert pipe; 25 lin. ft. of 4-in. tile drain; 5 cu. yds. of dry rubble masonry; 5 cu. yds. of cement rubble masonry; number of days bid for the completion of the work.

11. Cary avenue; and Post [avenue, from Columbia street to Richmond Avenue, in the Towns of Castleton and Northfield; estimated quantities, 10,225 sq. yds. of macadam renewals; 1,550 cu. yds. of excavation; 1,550 sq. ft. of new bridge stone; 650 sq. ft. of old bridge stone relaid; 200 sq. yds. of new specification block pavement; price per sq. yd. for relaying old block pavement; price per lineal foot for 6, 8, 10 and 12-in. culvert pipe; number of days bid for the completion of the work.

12. Fingerboard Road, in the Town of Southfield, from Richmond road to Station 61-00 near Sand lane; estimated quantities, 10,900 sq. yds. of macadam pavement; 12,170 cu. yds. of excavation; 105 lin. ft. of 12-in. culvert pipe; 70 lin. ft. of 15-in. culvert pipe; 35 lin. ft. of 24-in. culvert pipe; 5 cu. yds. of cement rubble masonry; 5 cu. yds. of dry rubble masonry; 600 lin. ft. of 4-in. tile drain; price per lineal foot for furnishing and laying 8-in. culvert pipe; price per lineal foot for rebuilding old stone culverts; number o days bid for the completion of the work.

13. Richmond Terrace, from Richmond avenue to the westerly line of the Harbor road, in the town of Northfield; estimated quantities, 19,500 sq. yds. of macadam renewals; 4,400 cu. yds. of excavation; 1,100 sq. ft. of new bridge stone; 2,000 sq. ft. of old bridge stone relaid; 10 sq. yds. of new specification block pavement; 35 sq. yds. of old block pavement relaid; 35 lin. ft. of 8-in. culvert pipe; 35 lin. ft. of 12-in. culvert pipe; 35 lin. ft. of 15-in. culvert pipe; 35 lin. ft. of 20-in. culvert pipe; number of days bid for the completion of the work.

14. Broad street, in the town of Middletown, from the westerly line of Bay street to the easterly line of Richmond road; estimated quantities, 5,350 sq. yds. of macadam renewals; 2,200 cu. yds. of excavation; 800 sq. ft. of new bridge stone; 400 sq. ft. of old bridge stone relaid; 10 sq. yds. of new specification block pavement; number of days bid for the completion of the work.

Plans and specifications more exactly setting forth the nature and amount of the work to be done, and the conditions under which the contracts for the same will be let, are now on file in the office of the Engineer of County Roads, Savings Bank Building, Stapleton, S. I.

The right to reject any or all bids for the above work is reserved by said Board of Supervisors of Richmond County, as may be deemed for the best interests of the county.

By order of the Board of Supervisors.
FRANKLIN C. VITT, Clerk.

P. O. Address, Stapleton, S. I.

Specifications and prints to be had only on personal application at this office. 25-3t

BRICK PAVING, WAUKEGAN, ILL.

NOTICE TO CONTRACTORS.

Sealed bids, indorsed with the title of the work and name of bidder, will be received by the City Clerk of the City of Waukegan until 6 o'clock p. m., July 15, 1895, for grading, laying, 1,110 lin. ft. curbing and 2,800 sq. yds. of brick pavement, more or less, on Genesee street, under an ordinance of said city, entitled, "An Ordinance for the Improvement of Genesee street from the North Line of Grand avenue to the North Line of Clayton street, in the City of Waukegan, County of Lake and State of Illinois, and for the Levying of a Special Tax Therefor," Approved April 5, 1895.

Plans and specifications for the work to be done are on file in the office of the City Clerk of the City of Waukegan, and copies of specifications can be obtained on application to said City Clerk. Bids must be made on printed blanks provided for the purpose, which are bound with the specifications. And all bids either on all or any part of the work must be accompanied by a certified check for the sum of $300, made payable to the city of Waukegan, which sum shall be forfeited and paid to the city of Waukegan on failure of bidder to enter into contract within 10 days after being awarded contract. Checks of unsuccessful bidders will be returned within two weeks after date of awarding contract. The City Council reserves the right to reject any and all bids.

ROBERT B. CONOLLY, City Clerk.
June 8, 1895. 25-2t

NOTICE TO CONTRACTORS.

Sealed bids indorsed with the title of the work and name of bidder will be received by the City Clerk of the city of Waukegan, until six o'clock p. m., July 15, 1895, for grading, laying 3,930 lin. ft. curbing, and 10,365 sq. yds., of brick pavement, more or less, on Madison, County and Washington streets, under an ordinance of said city entitled, "An ordinance for the Improvement of Madison street from 14 ft. east of the west line of State street to the east line of Genesee street, and from the west line of Genesee street to the west line of County street, and of County street from the south line of Madison street to the north line of Washington street, and of Washington street from the west line of County street to the wes line of West street in the city of Waukegan, County of Lake and State of Illinois, and for the levying of a special tax therefor.' Approved April 5, 1895.

Plans and specifications for the work to be done are on file in the office of the City Clerk of the City of Waukegan, and copies of specifications can be obtained on application to said City Clerk. Bids must be made on printed blanks provided for the purpose, which are bound with the specifications; and all bids either on all or any part of the work must be accompanied by a certified check for the sum of $700, made payable to the City of Waukegan, which sum shall be forfeited and paid to the City of Waukegan on failure of bidder to enter into contract within 10 days after being awarded contract. Checks of unsuccessful bidders will be returned within two weeks after date of awarding contract.

The City Council reserves the right to reject any and all bids.

ROBERT B. CONNOLLY, City Clerk,
June 8, 1895. 25-2t

PUMPING ENGINE, ASBURY PARK, N. J.

PROPOSALS WANTED.

Sealed proposals addressed to the undersigned, will be received until 12 o'clock m., June 28, 1895, at the office of the Water Commissioners of Asbury Park, N. J., for a one million gallon pump delivered and erected complete at main pumping station, Asbury Park, N. J., also for a two million gallon pump under similar conditions.

The Water Commissioners reserve the right to reject any or all bids, or to accept any that they may deem most advantageous to the interests of the borough. Specifications can be had at the office of the Water Commissioners.

GEORGE W. TREAT,
JOHN L. COFFIN,
Water Commissioners.
ASBURY PARK, N. J., June 14, 1895. 25-2

NOTICE TO SEWER CONTRATORS.

CITY OF PITTSFIELD, MASS.

Sealed proposals for building about one and three-quarter miles of pipe sewers in the City of Pittsfield, Mass., will be received by the Board of Public Works of said city until 12 (M.), July 10, 1895, when they will be opened and read in the presence of competitors.

All proposals must be on blank forms furnished by said Board and must be accompanied by a certified check, payable to said city, for $500.

Pipe, brick, cement and iron manhole castings will be furnished by said city. Plans and profiles can be seen and specifications and form of contract obtained at the office of Ernest W. Bowditch, 60 Devonshire street, Boston, Mass.

No bid will be received unless the bidder has looked the work over on the ground.

Said Board reserves the right to reject any or all bids.

ERNEST W. BOWDITCH,
26-1t Engineer.

NOTICE TO CONTRACTORS.

SEWER MATERIALS, CITY OF PITTSFIELD, MASS.

Sealed proposals for the furnishing of any of the following materials will be received by the Board of Public Works for the City of Pittsfield, Mass., up to the hour of 12 M. on the 10th of July, 1895, at the City Hall in Pittsfield, at which time and place all persons competing are invited to be present. The proposals will then be opened and read, and no proposals will be received after that time, except upon rejection of all proposals then presented.

Specifications can be seen at the office of Ernest W. Bowditch, 60 Devonshire street, Boston, Mass., and at the office of the Board of Public Works, Pittsfield, Mass.

All proposals must be made upon blank forms, furnished by said Board, and must be accompanied by a certified check for the following amounts:

With bid on brick, $75.
With bid on manhole castings, $50.
With bid on vitrified sewer pipe and specials, $75.
With bid on cement, $50.

The approximate quantities required are:
Brick, 76,000.
Pipe (including specials) 9,000 feet.
Cement, 250 bbls., American, and 50 bbls. Portland.
Manhole castings (frames and covers), 36 sets.

The Board of Public Works reserve the right to reject any or all bids.

ERNEST W. BOWDITCH, Engineer.
26-1t

NOTICE TO SEWER CONTRACTORS.

TOWN OF WINCHESTER, MASS.

Sealed proposals for building about three miles of pipe sewers will be received by the Sewer Commissioners of the Town of Winchester, Mass., at their office, the Town Hall Building of said town, until 12 m. of Tuesday, July 2d, 1895.

The award of the contract, if awarded, will be made as soon thereafter as practicable.

All proposals must be on blank forms furnished by said town, and must be accompanied by a certified check for $1,000, drawn on some National Bank of the City of Boston and made payable to the Treasurer of the Town of Winchester.

Some of the approximate quantities are as follows:

3,310 linear feet of 6 inch sewer.
3,230 " " 8 " "
6,622 " " 10 " "
428 " " 12 " "
1,913 " " 15 " "
150 cubic yards of brick masonry in manholes.
15,000 cubic yards of excavation at various depths.

Bricks, pipes, cement, and iron castings will be furnished by the town. Plans can be seen, and specifications, forms of contracts and proposals obtained at the office of the Engineer in charge of Sewers, at the Town Hall Building, Winchester, Mass. The Sewer Commissioners reserve the right to reject any or all bids.

ERNEST W. BOWDITCH,
26-1t Chief Engineer.

MACADAMIZING.

MORRIS COUNTY, N. J.

Proposals for the macadamizing certain roads in Morris County will be received by the Board of Freeholders not later than Wednesday, July 16, 1895.

Specifications and all information furnished upon application to WM. E. KING, County Engineer, Landing, N. J., or of J. C. WHITE, Clerk, Morristown, N. J. 25-3t

WATER-WORKS--RED HOOK, N. Y

NOTICE TO CONTRACTORS.

Proposals will be received by the Board of Water Commissioners of the Village of Red Hook, N. Y., at their office in said village, until 2 o'clock p. m., on July 9, 1895, for the material and labor required to construct waterworks in said Village of Red Hook, N. Y. Also for hose, cart, truck and ladders.

Bids will be received for furnishing and laying about eight miles of pipe, reservoir, hydrants, valves, pumps, boilers and stand-pipe.

The right is reserved to reject any and all proposals. Blank bids and specifications for the water-works can be obtained of the Water Commissioners, and plans will be exhibited by them ten days prior to the day of letting.

D. W. WILBUR,
H. L. COOKINGHAM,
H. PROSEUS,
H. ELLSWORTH,
Board of Water Commissioners of the Village of Red Hook, N. Y. 26-1t

PROPOSALS FOR WORK AT BLOCK ISLAND.

Sealed proposals will be received at the office of the Town Clerk of New Shoreham, Block Island, R. I., by the committee for such town, until 12 o'clock noon on the 29th day of June, 1895, for 20,200 tons of stone, 85 m. feet of pile sheathing and 160 piles, required for extending and building breakwaters at the channel connecting the Great Salt Pond with the ocean, in accordance with drawings and specifications, copies of which specifications may be had on application at this office. The committee will reject all bids received after the time herein stated for opening the same. Proposals must be inclosed, sealed and marked "Proposals for Breakwater at Great Salt Pond," or "Proposals for Pile Sheathing at Great Salt Pond," and addressed to EDWARD P. CHAMPLIN, Town Clerk, Block Island, R. I.

EDWARD P. CHAMPLIN,
26-1t Clerk of the Committee.

WATER-WORKS.—MONMOUTH, ILL.

Sealed proposals will be received at the office of the City Clerk of the City of Monmouth, Ill. up until 12 o'clock noon of Monday, July 8th, 1895, for the purpose of furnishing all the labor and materials necessary for the laying of the following approximate amount of water mains: 6,000 feet of four-inch pipe and 5,000 feet of six-inch pipe, including all the necessary hydrants, valves and special castings. Plans, profiles and specifications can be seen at the office of the City Engineer or the City Clerk. Each bid must be accompanied by a certified check on some Monmouth bank for $300. Bids must be made upon blanks furnished by the City Engineer. The right is reserved to reject any or all bids.

THOS. S. McCLANAHAN,
City Engineer.
J. ARTHUR STEVENSON,
City Clerk. 26-t

SEWER-PIPE LAYING, BLOOMFIELD, N. J.

Sealed proposals will be received by the Township Committee of Bloomfield, N. J. until Monday, July 8, 1895, at 4:30 p. m., for the laying of about 7,233 ft. of 8-in. sewer pipe and about 3,250 ft. of 20-in. sewer pipe The following are the names of the streets to be sewered: Belleville avenue, from Broad street to Spruce street; Monroe place, from Park place to Spruce street; Park place, from Beach street to Liberty street; Liberty street, from Park place to Spruce street; Franklin street, from Washington street to a point 250 ft. south from Broad street; Montgomery street, from Spruce street to West street; Austin place, from Liberty street to Fremont street; Park street, from State street to a point near Broad street; Fremont street, from Franklin street to Spruce street, with 8-in. pipe; Montgomery street, from Franklin street to Spruce street, and Spruce street, from Montgomery street to Belleville avenue, with 20-in. pipe. Plans and specifications can be seen for the above work at the office of the sewer engineer, A. H. Olmsted, 27 Broad street, or specifications and bidding blanks will be sent to any address on application.

Each proposal must be sealed and endorsed "Sewer Proposals," and addressed to William L. Johnson, Township Clerk. Each bid must also be accompanied by a certified check for $1,000.

WM. L. JOHNSON,
26-2t Township Clerk.

CORPORATION NOTICE.

PROPOSALS FOR HOUSE CONNECTIONS, PLAINFIELD, N. J., SEWERS.

Pursuant to a resolution adopted by the Common Council of the City of Plainfield, N. J., at a special meeting thereof, held June 19, 1895, notice is hereby given that the Common Council will meet on July 8, 1895, at eight o'clock p. m. at the Council Chamber, 109 Park avenue, in the City of Plainfield, at which time and place said Common Council will receive sealed proposals for doing the work, and furnishing the materials, for the construction of house connections, from the sewers proper, to the curb lines, being part of the system of sewerage, with appurtenances necessary to complete the same contemplated in the ordinance, entitled "An Ordinance to Provide for the Construction of a System of Sewerage," approved July 25, 1894, as provided for in the plans and specifications, adopted by the Common Council June 19, 1895, and filed in the office of the City Clerk, 109 Park avenue, Plainfield, N. J. Upon receipt of the bids, or proposals, the Council will immediately proceed to unseal the same and publicly announce the contents in the presence of the parties bidding, or their agents, provided said parties, or agents, choose to be then and there present, and also to make proper record of the prices and terms upon the minutes of the Council.

Each proposal must be accompanied by a certified check for $500, payable to the Treasurer of the City of Plainfield.

The engineer's approximate estimate of the quantities of materials required, and the work to be done, is as follows:

32,000 lin. ft. four (4) in. house connections, to be constructed from the sewer proper to the curb lines.

Duplicate plans, specifications, contract, bond, etc., may be examined and forms of proposals may be obtained at the office of A. J. Gavett, Constructing Engineer, 109 Park Avenue, Plainfield, N. J.

The right to reject any or all bids is expressly reserved by the Common Council.

All proposals must be endorsed "Proposals for House Connections."

JAMES T. MACMURRAY,
City Clerk.

25-1t

To the Stockholders of the Engineering News Publishing Company:

Notice is hereby given that a meeting of the stockholders of this company will be held at its office in the Tribune Building, New York City, on the 5th day of July, 1895, at 12 o'clock noon, for the purpose of electing trustees and the transaction of other business.

Dated, New York, June 17, 1895.

GEO. H. FROST,
D. McN. STAUFFER,
Trustees.

25-2t

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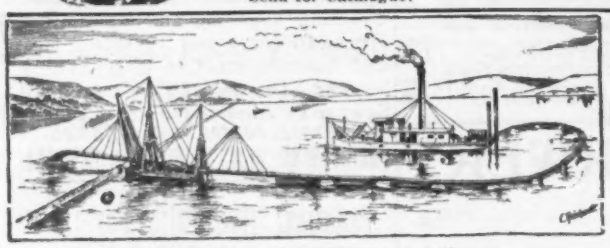

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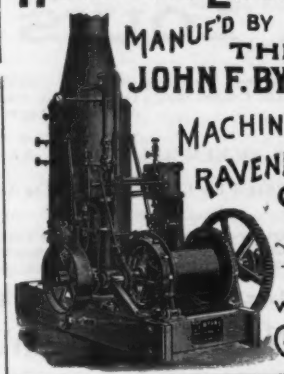

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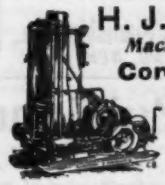

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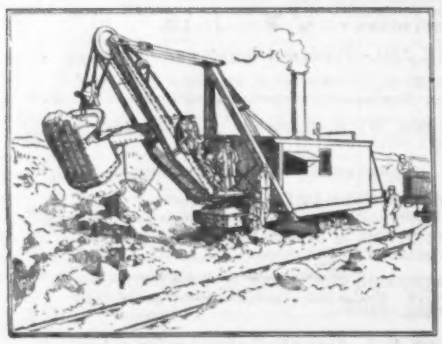

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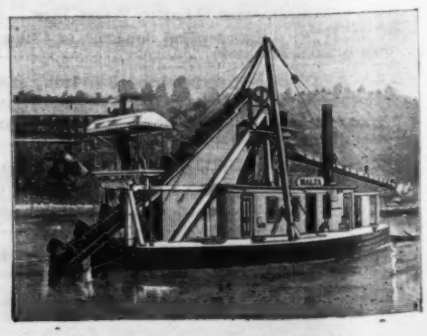

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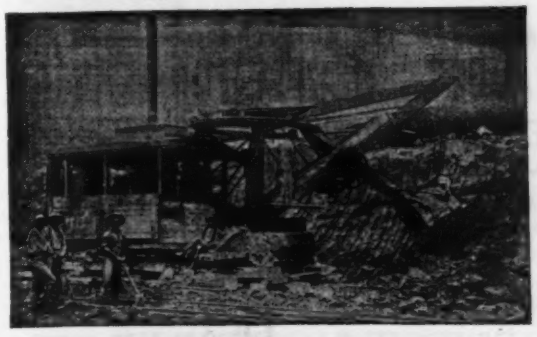

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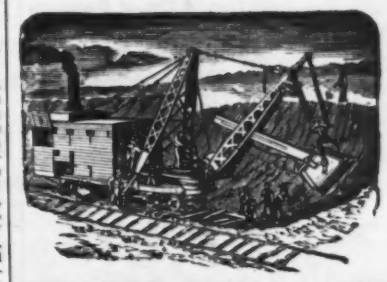

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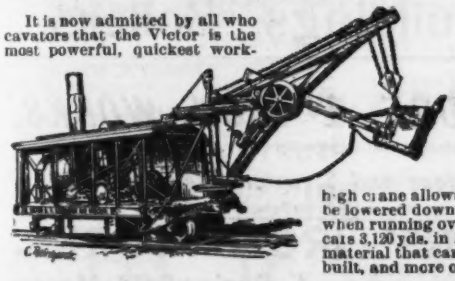

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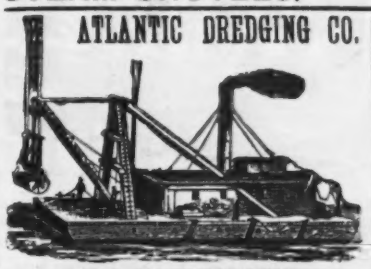

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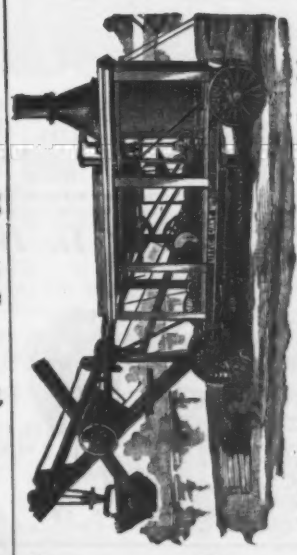

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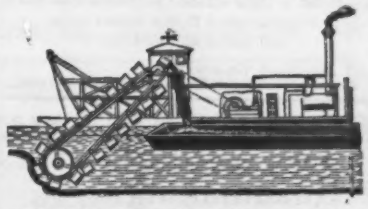

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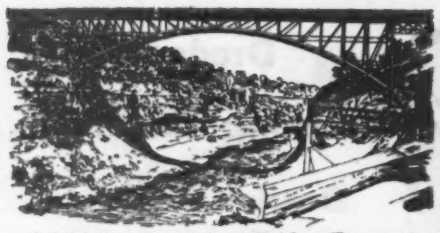

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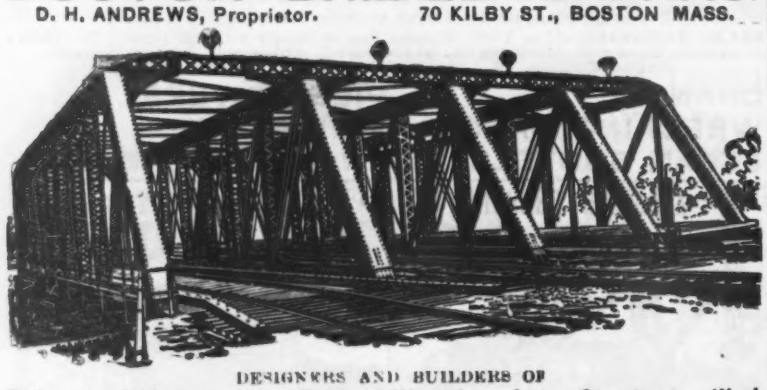

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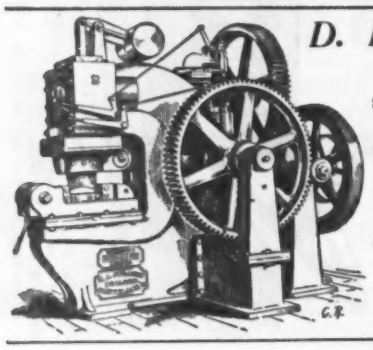

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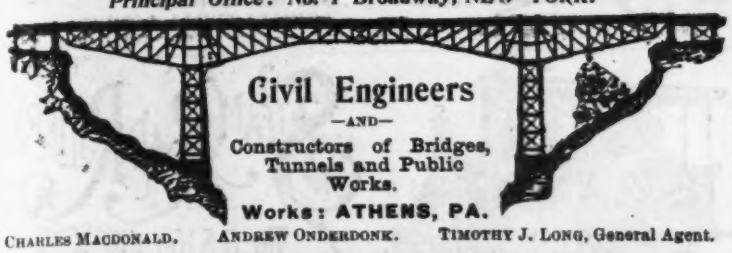

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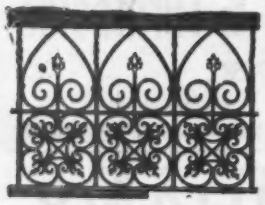

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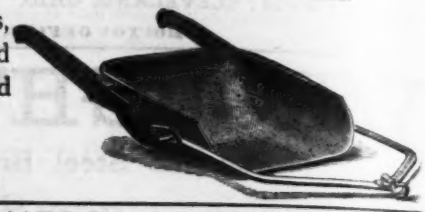

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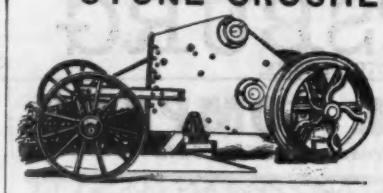

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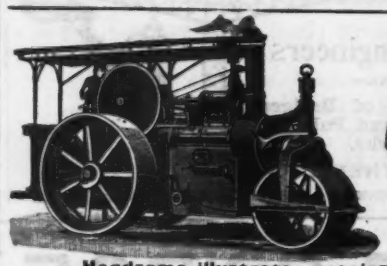

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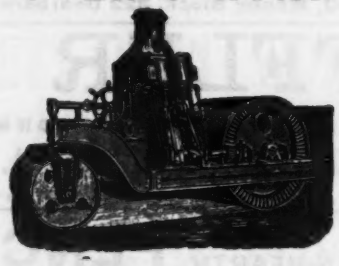

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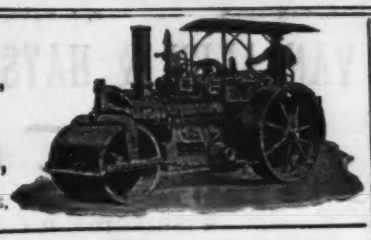

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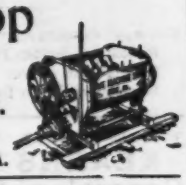

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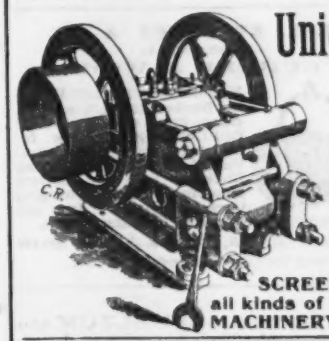

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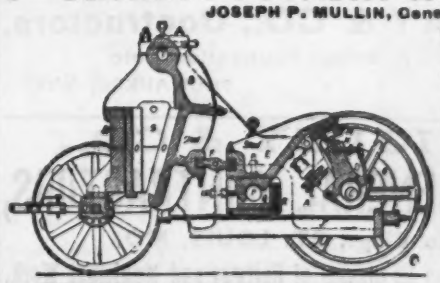

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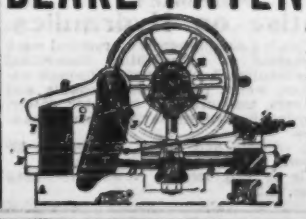

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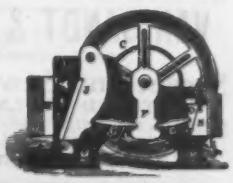

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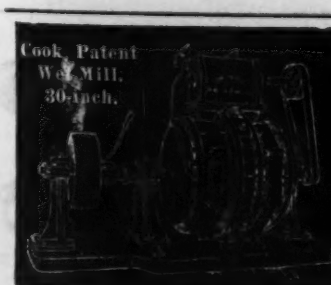

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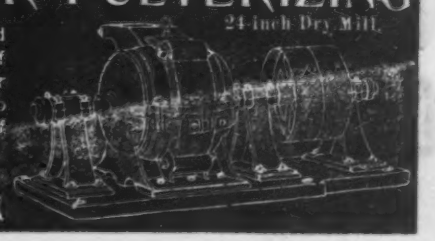

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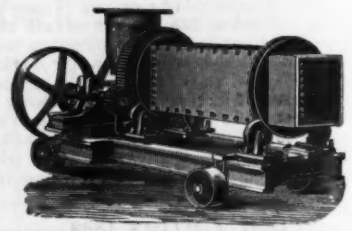

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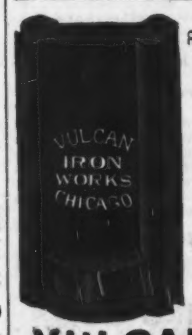

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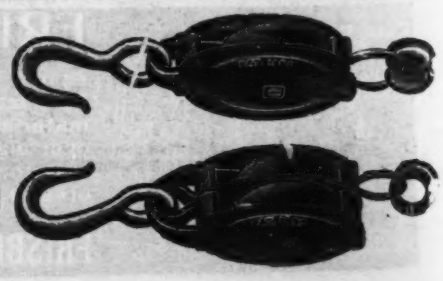

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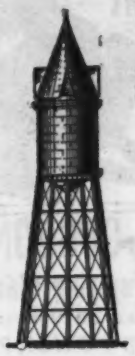

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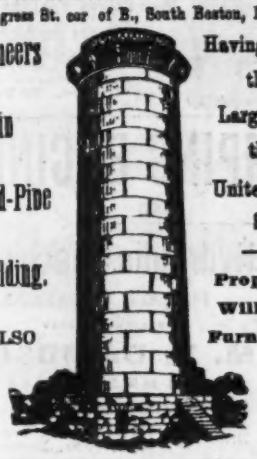

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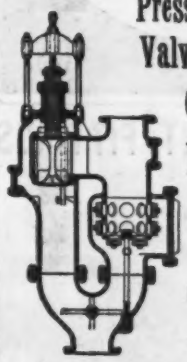

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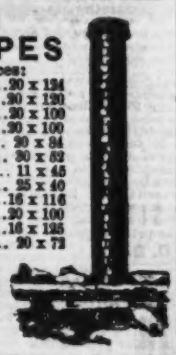

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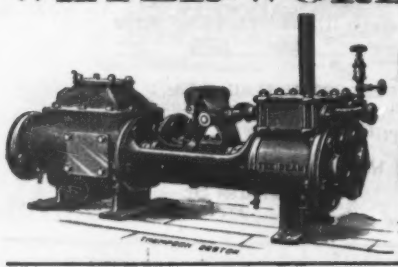

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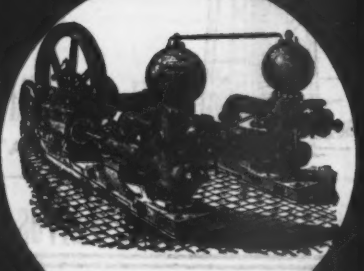

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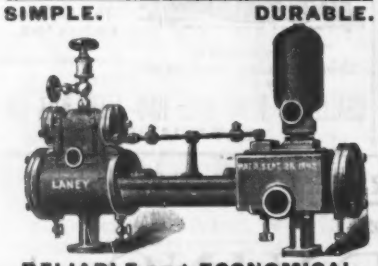

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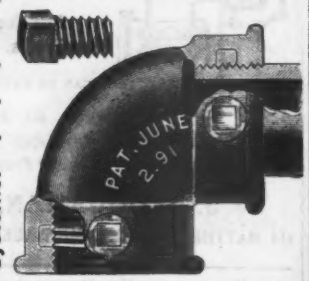

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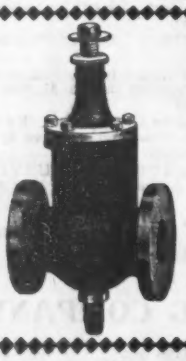

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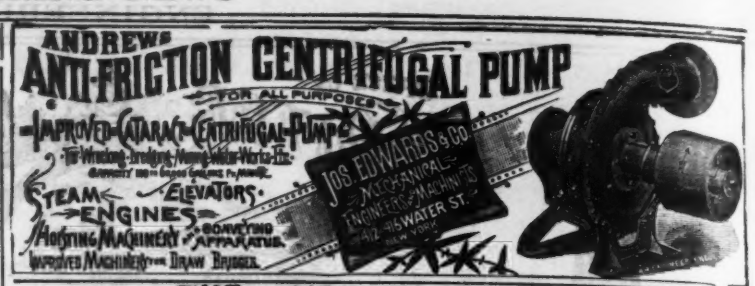

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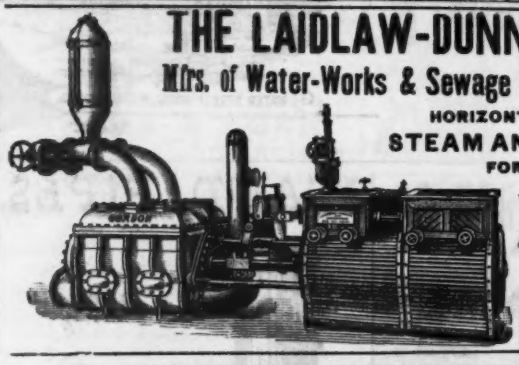

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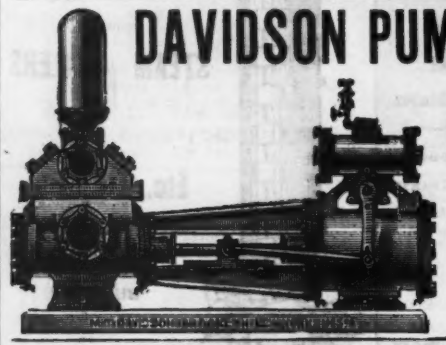

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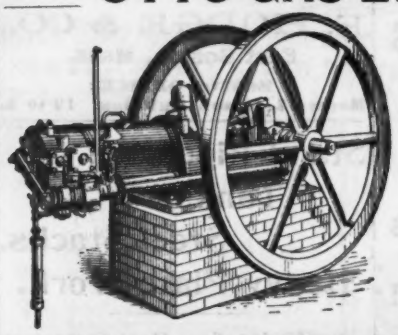

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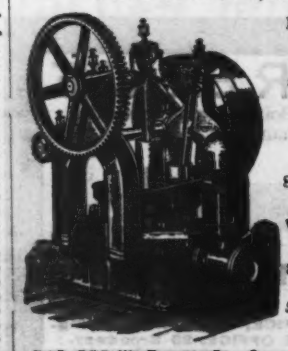

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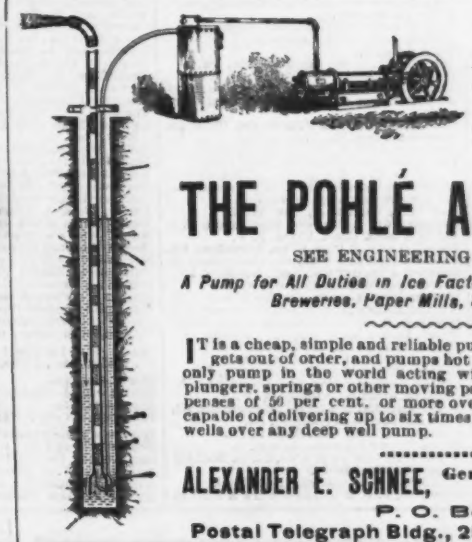

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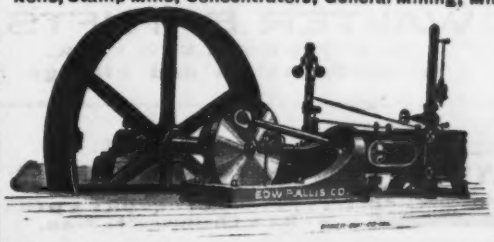

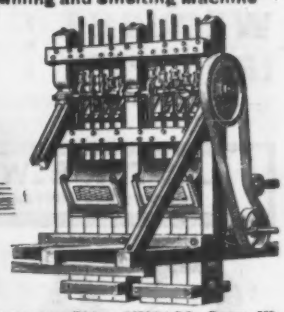

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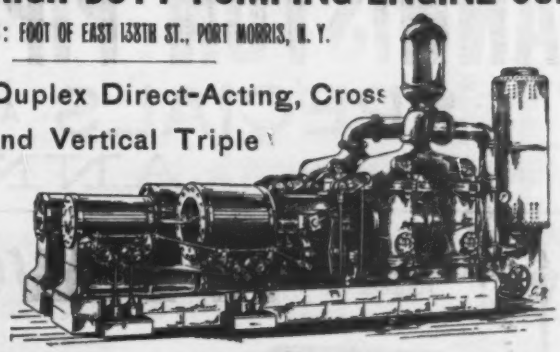

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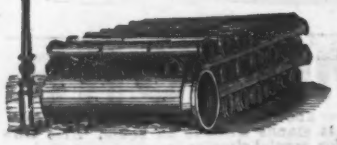
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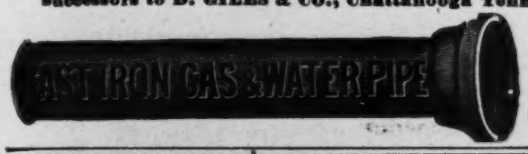

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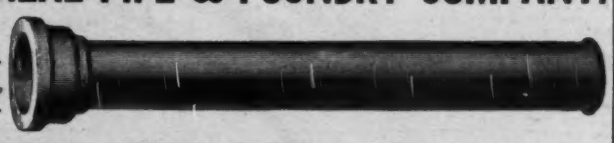

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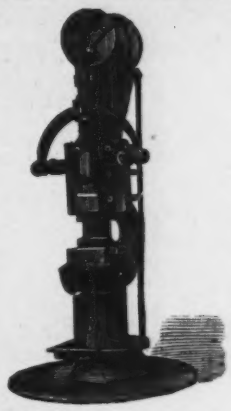

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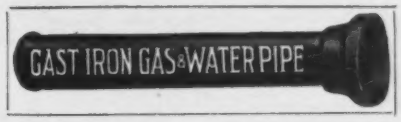

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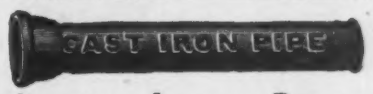

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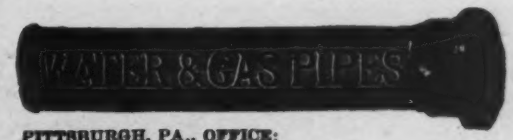

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